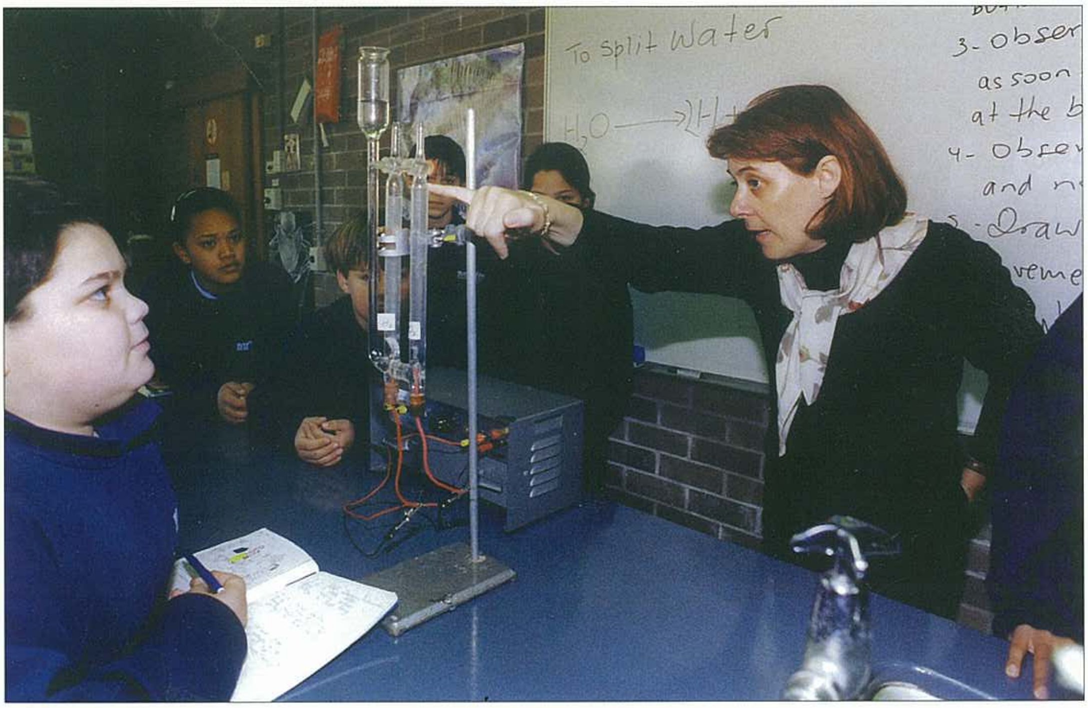
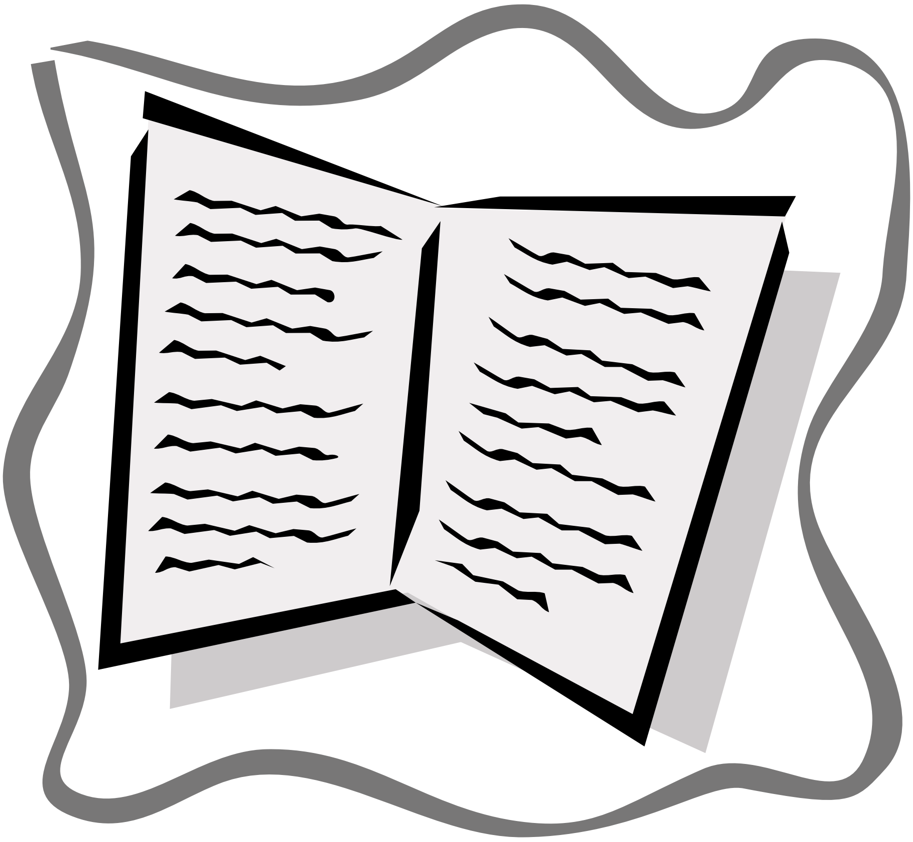
LITERACY



TEACHING LITERACY IN SCIENCE IN YEAR 7

NEW SOUTH WALES
DEPARTMENT
OF SCHOOL
EDUCATION



Teaching literacy in science in Year 7

NEW SOUTH WALES DEPARTMENT OF EDUCATION AND TRAINING

Curriculum K-12

NEALS

NEALS

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Contents

Chapter 1: The literacy demands of science

Consider a typical lesson introduction:

It is Period 1 on Friday and 7X are in Ms Newton's science class.

Teacher: OK Year 7, we are looking at volcanoes. Who saw the movie *"Volcano"*?

Student 1: It was wild; when it blew, the whole town got wiped.

Student 2: In New Zealand we lived near one. It was like this big mountain, we watched and you could see this red runny stuff come out and clouds came off it.

Teacher: What do scientists call the red runny stuff?

Student 2: Lava. *(Teacher writes "lava" on the board.)*

Teacher: What do we call it when it blows?

Student 3: Eruption. *(Teacher writes "eruption" on the board.)*

Teacher: How would a scientist describe the volcanic explosion?

Student 4: When a volcano erupts, lava flows…

In this brief transcript we can see that the teacher is providing a scaffold for the students' learning in a number of ways:

1. The teacher activates and makes links with prior learning.
2. The teacher provides a visual model of the students' responses.
3. The teacher provides explicit teaching of the subject-specific vocabulary and moves the students from their commonsense understandings of the topic to the technical understandings required.

As teachers we need to provide explicit instructions for students to meet the literacy demands of the various subject areas. This explicit teaching of literacy is integral to the teaching of content.

This book provides teachers with a variety of strategies for using a systematic approach to improving students' literacy achievements. It also provides a framework for teaching which can be applied to other science topics.

Here is a useful definition of literacy:

> *Literacy is the ability to read and use written information and to write appropriately, in a range of contexts. It is used to develop knowledge and understanding, to achieve personal growth and to function effectively in our society. Literacy also includes the recognition of number and basic mathematical signs and symbols within text.*
>
> *Literacy involves the integration of speaking, listening and critical thinking with reading and writing. Effective literacy is intrinsically purposeful, flexible and dynamic and continues to develop throughout an individual's lifetime.*
>
> *All Australians need to have effective literacy in English, not only for their personal benefit and welfare but also for Australia to reach its social and economic goals.*

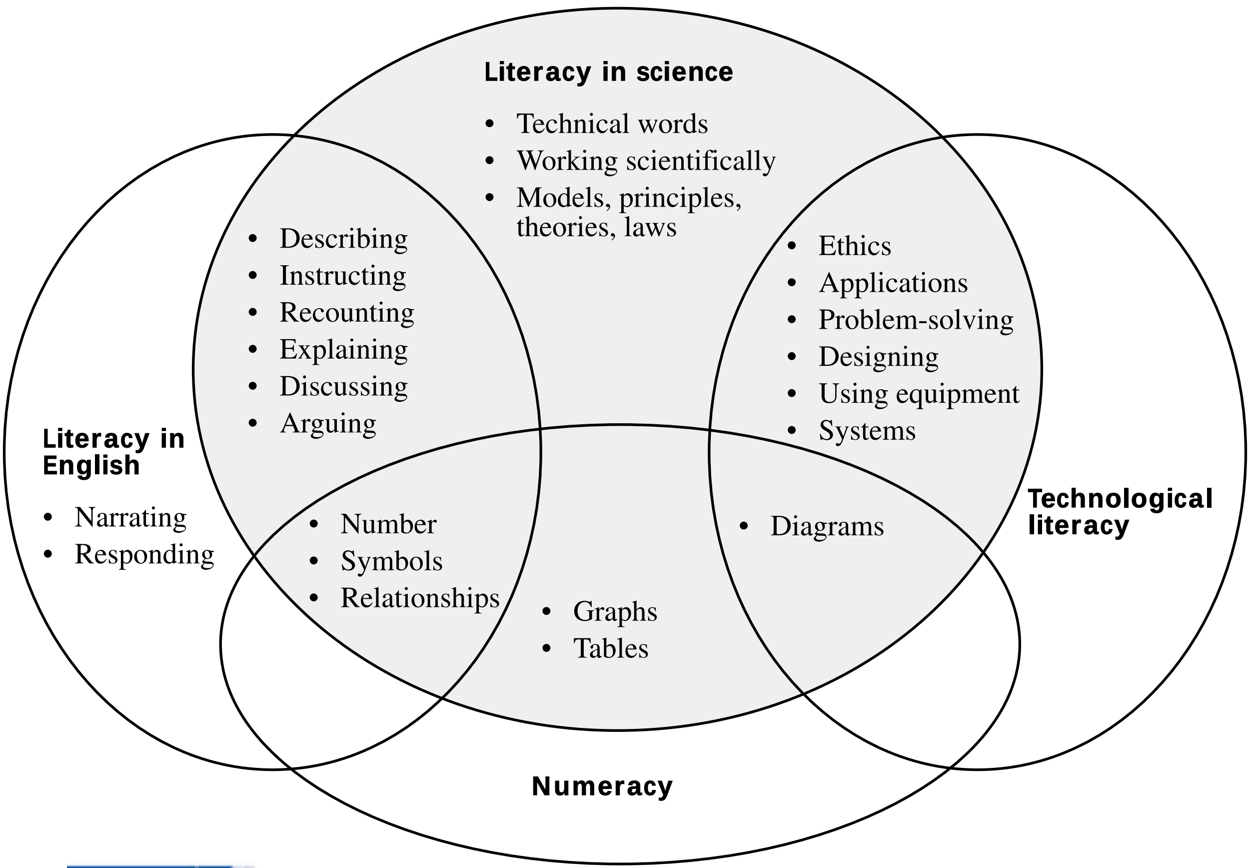
Australia's Language and Literacy Policy,
Companion Volume to Policy Paper, 1991.

Just what are we referring to when we talk about literacy in science?

Literacy is a word with very broad meanings. We hear people speak of scientific literacy, computer literacy, media literacy. When literacy is used in these ways it is a metaphor for "understanding and applying" and what we really mean is understanding and applying science, understanding and applying computers or understanding the media.

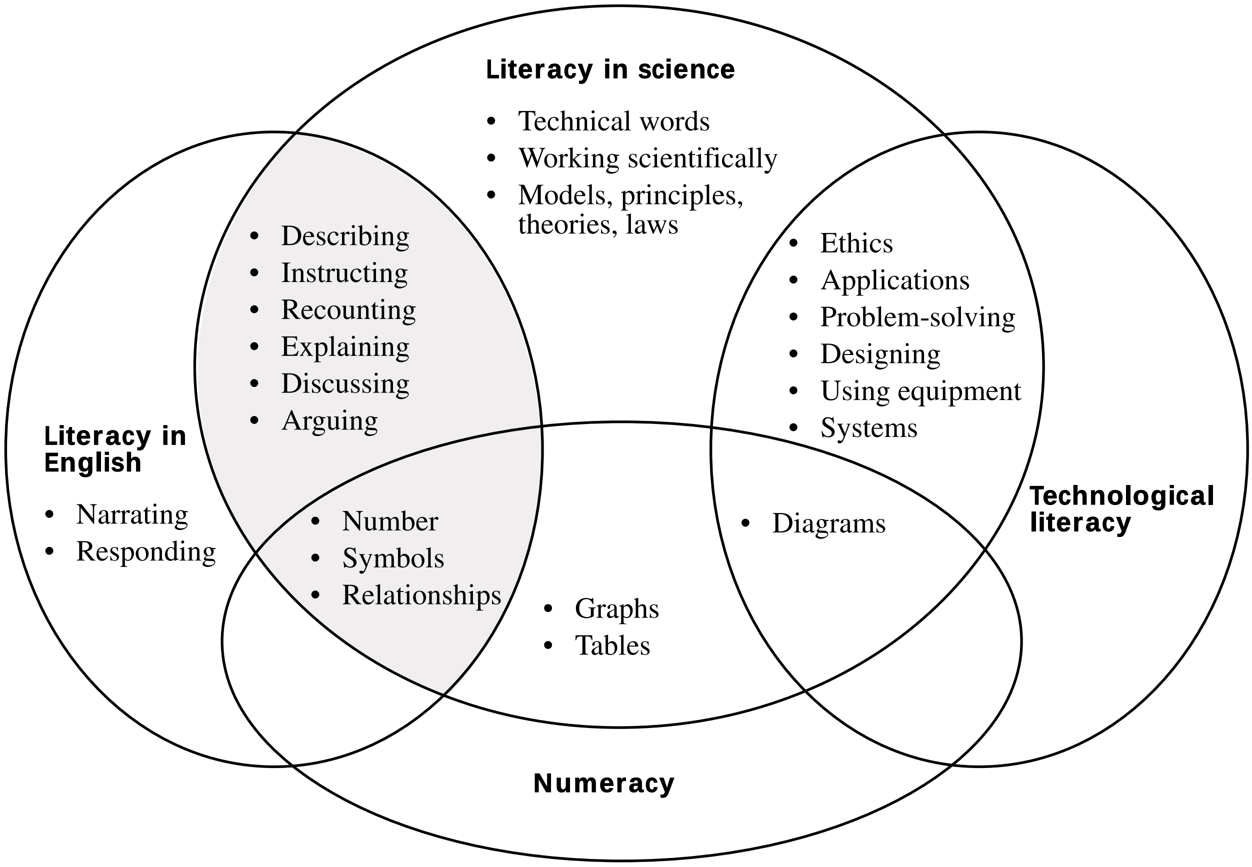
Scientific literacy can be thought of in terms of the circle shaded in the following diagram.

Science has elements which are exclusive to the subject but it also incorporates significant elements from the "circles" of literacy in English, numeracy and technological literacy.



What we are doing in this book is to show how language is used to construct meaning in science. The English language does not provide a complete understanding of science but it does provide a substantial part of it. As a result of their school science courses, students should be able to use language to achieve a number of purposes.

The area on which this book concentrates is the intersection between the circles *Literacy in English* and *Literacy in science*.



Why teach literacy as part of our science curriculum?

It is important to assist students with these literacy skills because the systematic and explicit teaching and learning of science content are impeded when students are unable to listen, speak, read and write appropriately.

> For effective learning in science, students need to be able to use literacy skills to analyse and respond to the world around them, to construct knowledge in a systematic way and to convey their understandings to others.

Science students are expected to **listen, talk, read** and **write** for such purposes as:

- describing
- classifying
- predicting
- instructing
- summarising
- discussing
- arguing
- explaining
- recounting.

In science, effective **listening** allows students to gain information and follow instructions. Students can also analyse speech critically to ascertain the purpose of the author, so they can respond appropriately. To do this they need to recognise the structure of language and be able to detect the intention of the author of the text. They need to interact in group processes and seek clarification. Effective listeners attend to tone of voice, language used (emotive versus factual, degree of certainty or confidence), body language and the relationship established between the speaker and the listener.

Speaking in science assists students to link prior understanding to new knowledge. Speech engages the learner and allows the sharing, reflection and modification of thoughts so that students can better construct scientific meaning. It can also assist students to recognise and pronounce unfamiliar words. Speaking activities in science lessons help prepare students for reading and writing tasks and so it is important for students to be able to choose the forms of speaking appropriate to their purpose, audience and context.

By listening to students speaking, teachers can determine their prior understanding and monitor and assess their learning.

Students need to **read** to expand their view of and interest in the world of science. Additionally, through reading they can expand their interest and understanding of science. In science, students need to read so that they can follow instructions and obtain information. We should be encouraging our students to gather information from a variety of sources, including books, newspapers, magazines, videos, slides, multimedia and the Internet.

While reading, it is useful for students to recognise the organisational elements in texts. This will assist them to recognise the purposes within text and to critically analyse it to determine how the writer is attempting to position or influence them. Students studying science also need to recognise that scientific diagrams, tables and graphs, symbols and mathematical relationships can also be used to explain, describe, instruct and argue. When students transform these familiar scientific records to appropriate written texts they need to refine and express their understandings. Students should also be able to transfer written texts to graphic and symbolic representations.

Students should be encouraged to use a variety of reading skills including: skimming and scanning techniques; re-reading; consulting indexes, contents, glossaries. Students should also be supported when they read aloud so that their competence as readers grows.

In science, students are expected to **write** to share their findings and understandings, to clarify meaning, to respond to information presented to them and to present a particular point of view.

Science presents a myriad of opportunities to develop a range of literacy skills in writing because science topic knowledge can be built through practical activities in the first instance. Students who are not confident readers can become successful writers through a knowledge of how texts are structured. This knowledge will then assist their reading.

To be successful in writing in science students need to be able to apply an understanding of the way different types of texts are organised so that they can construct a text appropriate for their purpose and audience.

Students need to recognise that in scientific writing it is especially important to choose appropriate technical words (like *mass, velocity*, *condensation* and *rate of change*) and to use numerical relationships, diagrams, tables, graphs, flow charts and drawings to convey meaning.

Students should recognise that the process of writing involves planning, gathering and sorting information, drafting, conferencing, proofreading, editing and presenting. They should be encouraged to use a multi-strategy approach to spelling (i.e. use strategies such as developing personal vocabulary lists; using a dictionary, thesaurus or spelling checker on a word processor; building recognition of word groups).

Chapter 2 : The continuum of literacy development

During their primary years students will have been involved in a wide range of literacy experiences in all subjects.

A functional view of language

The Department of School Education supports a functional view of language as the basis for all literacy activities. This view emphasises the ways language is used as a medium for social intercourse and in order to make meaning.

Language enables people to do things, to share information, to enquire, to express opinions, to entertain, to argue, to have needs met, to reflect, to construct ideas, to order experience and to make sense of the world. Literacy is concerned with how people use language for real purposes in a variety of social situations. All these language exchanges, whether spoken or written, formal or informal, are called **texts**.

A functional view of language recognises the ways in which the particular language choices we make in any situation influence, and are influenced by, the people involved, the subject matter and how the message is transferred. The roles and relationships existing between the speaker and the listener or between the reader and the writer influence the words which will be used and the ways in which the text will be structured.

The subject matter will also influence the language choices. In a science text for students you would expect to find language which instructs, such as *collect equipment* and *record information in a table*. You would also expect to find words which name the equipment to be used, such as *tripod* and *bunsen burner*, processes such as *observe*, *record*, *conclude,* and technical words which relate to scientific concepts such as *reaction, velocity, mass* and *hypothesis*.

The language we use has evolved within a culture which has particular beliefs, values, needs and ways of thinking about the world. Our language is shaped by these cultural factors and in turn shapes the culture. For example, in the English language we have only one word *snow* which describes all different kinds of snow. Eskimo people have ten different words for *snow,* covering all the different weather conditions. They need to be able to define *snow* more distinctly because their survival could depend upon what weather conditions are prevailing.

Primary school experiences

During their primary years students will have been engaged in talking, listening, reading and writing for a range of purposes which would have led them to become familiar with a variety of different forms of reading, writing, talking and listening. These different forms of language are often called **text types**. We can group them together, based on features they have in common, and give them names, such as:

- discussion
- explanation
- exposition
- narrative
- recount
- report
- response.

Students' skills in recognising and using these text types are developed in different ways in primary and secondary years. Primary teachers tend to use an integrated model of teaching where the boundaries between the various KLAs are often blurred. For example a thematic unit of work in Year 6 on "Space" might incorporate aspects of science, technology, English, mathematics and HSIE. Within this unit of work students would have been speaking, listening, reading and writing for a number of purposes. They would have produced such texts as information reports, discussions, explanations and narratives.

The implications of this teaching approach is that the students often do not recognise the KLA or the content as separate from the way of reading and writing. Students therefore sometimes have difficulty in transferring their learning from the primary school to the secondary school setting. In order to link with students' prior experiences, secondary teachers must incorporate language perspectives into their teaching. For example, students may think that writing explanations is something they do when they write about "Space" and not recognise that it is an appropriate form of writing in many different contexts.

Secondary school experiences

Many of the tasks in which students will be involved during secondary school will require them to incorporate the features of several text types.

Consider a task like this:

> *Identify ten processed foods which you can buy or which you have at home. Describe the additives in them and discuss the health benefits or risks of these.*

Students should be shown how to break up the task into its component parts. Let's think about what this task is actually asking of the students.

1. *Identify ten processed foods* requires students to look at a number of food products and read the packaging to determine which have additives. They would then need to locate the information about additives on the packaging, list these, and probably classify them depending upon whether they are, for example, *food colours, preservatives* or *flavour enhancers.* Students might require assistance with finding where on the packaging this information is located and with reading the names and symbols used to describe them. The teacher would probably need to develop the students' understandings of these additives using spoken language, so that they can read them with understanding and reproduce them correctly in writing.
2. *Describe the additives in them* requires students to define processed foods and list some examples with their additives. They might use a table and would probably include an explanation of how some of the additives work.
3. *Discuss the health benefits* requires students to provide information about the benefits of some food additives.
4. *Discuss the health risks* requires students to provide information about the risks of some food additives.

Often tasks such as these require students to conclude with a recommendation or a general statement about the benefits and risks.

When setting tasks such as this, it is important that you are clear about the purpose of the task and what you expect the students to produce, and that you explain this clearly to the students. It is particularly important that you make explicit the criteria which will be used to evaluate their efforts.

Implications for teachers of science in Year 7

This book will provide you with a range of practical ways for addressing the learning needs of students. We need to take account of the prior learning experiences of students and make links with these experiences.

For primary school students, the literacy demands of science and technology (as set out in the Science and Technology K-6 syllabus) include:

- knowing and understanding that information can be represented in a number of different forms, including graphics, sounds and texts
- being able to describe the processes of investigation, which can involve exploring and discovering phenomena and events, proposing explanations, initiating investigations, predicting outcomes, testing, modifying and applying understanding.

By Year 7 students generally have already learned a great deal about:

- the processes of investigation
- the process of designing, making and appraising, and
- technology and how it affects other people, the environment and the future.

In providing support for students to meet the literacy demands of science in the Year 7 curriculum, we need to recognise that we are also preparing students for the further demands of the subject in Stage 5 (and, for some, Stage 6).

In high school, the literacy demands of science are described in the Science Years 7-10 syllabus. The syllabus states that, by the end of Year 10, students will be able to:

- present oral reports confidently
- take part in classroom debates
- participate actively in classroom discussion
- interpret a variety of forms of information
- predict outcomes, generate hypotheses and explanations related to phenomena both within and outside their own experience
- formulate cause-and-effect relationships in explaining a relevant set of observations or experimental results
- formulate a generalisation as an explanation for a relevant set of observations or experimental results
- organise complex information, ideas and arguments, using a variety of media
- select, summarise and organise ideas and information from a variety of sources
- use complex drawings, tables and graphs to organise and retrieve information
- appreciate the need for careful assessment of science reports in the media.

In science in Years 7-10, students are likely to be asked to engage in oral reports, procedures, recounts, explanations, discussions, and expositions, and then to read and write these types of texts. While initially students will be examining these **text types** in isolation, many of the tasks that will confront them will require them to incorporate the features of several different text types.

Generally, students will need explicit teaching if they are to understand the more sophisticated literacy demands of HSC science courses. Teachers need to find a way of explaining how language works in science.

In working towards syllabus outcomes students will often be attempting language tasks which are new to them. These tasks need to be analysed in order to ascertain the specific demands that they will make on students. Once these demands are recognised and understood, students should be given appropriate support when they need it.

By the HSC, these students will be expected to be able to do such things as the following:

- obtain information from scientific literature, including "popular" scientific writings and historical documents
- critically evaluate information
- correctly use the language of science
- state ideas precisely and accurately, in speech and in writing
- produce experimental reports in a recognised scientific format
- form and evaluate conclusions.

Supporting students as learners

Students become literate as they use language to interact with peers, teachers and the wider school community in many contexts. Therefore, students should have many opportunities to interact with others to express feelings and opinions and to listen and respond to the views of others. Students should have experiences with a wide range of texts.

In all subjects, students develop understandings and learn new concepts and skills through the use of language. As they explore their environment, investigate problems and participate in cooperative learning activities, they use language to clarify their thinking, to share and test ideas, to communicate with others and to reflect on their own learning and respond to what they hear and see. Learning experiences should be designed to involve students in speaking and listening, reading and writing a variety of texts which relate closely to real-world purposes.

As an example, consider the group assignment "*Develop the best mouse-trap-powered racer*". In this activity students will cooperatively plan and carry out tasks, gather background information (perhaps on machines, materials, forces and friction), design and construct a model, design and evaluate experimental tests and present written and oral reports. Through these activities students will be engaged in describing, instructing, explaining and arguing, using oral and written text forms.

Students should have opportunities to become confident in speaking and writing in a variety of contexts. They should be encouraged to experiment with and explore ways of expressing ideas and communicating meaning as they develop their skills in writing for various purposes and audiences. They should be helped to develop as independent learners as they use language to make their meanings clear to themselves and others.

In order to understand how language works, students should talk frequently about the written and spoken texts with which they are working. They should have many opportunities to read, write, talk and listen and to focus on the grammatical features that successful texts employ (e.g. recognising that verbs begin sentences in effective procedures). In this way students will develop a "shared language" for describing the way language works to achieve particular purposes in science.

Students need to become actively involved in both informal and structured demonstrations of language in action within science. Learning experiences should provide models of successful texts and opportunities for students to create their own texts with support as they move towards independence. There should be frequent opportunities for students to participate with their teachers and other learners in the joint construction of texts, before they are encouraged to create texts alone.

For students to be successful in science, opportunities need to be provided for students to understand and use a variety of text forms. Thus, after practical work in science students should be asked to write simple **procedures**, **reports, recounts** and **explanations** as well as other more complex forms of experimental records. These more complex forms could include predict-observe-explain (see page 68), simple laboratory notes, entries in a personal learning journal or as a traditional experimental report.

Learning environments need to be structured so that students are encouraged and supported to take risks and to recognise that learning involves a process of progressive refinement of knowledge, skills and understanding related to the activity with which they are engaged. Students need to feel that it is acceptable and appropriate to make approximations based on the level of knowledge and awareness they currently have about science and literacy, while the teacher continues to provide exemplary models.

The learning activities in science should be designed around real texts. Authentic texts, both spoken and written, form a context for teaching about science, about how language works and provide a framework for achieving syllabus outcomes. For many students in Years 7 and 8 these texts will be in forms such as science text books, reference books, videos, popular science magazines, some Internet sites, selected newspaper articles, zoo and museum guides and explanatory notes and science competitions.

Chapter 3: Assessing, planning and programming for explicit teaching

In order to plan appropriate programs you first need to ascertain what skills, knowledge and understandings your students currently have. This information needs to be considered in relation to the content which is to be taught and the literacy skills the students have which will enable them to understand the content.

The Department of School Education's document, *Principles for assessment and reporting in NSW government schools* (1996), sets out some useful guidelines for assessing students' achievement and should be read in conjunction with this chapter. It provides advice about assessment within an outcomes approach and the forms of assessment which you can use to make judgments about students' achievements and progress. Some assessment strategies which are discussed are: collecting student work samples and annotating these against a set of criteria; using self and peer assessment of work against a predetermined set of criteria; and assessing performances such as debates, demonstrations and projects.

Further information about practical assessment strategies is contained in the Board of Studies document, *Assessing and Reporting using Staged Outcomes, Part 1 Assessing* (1996).

Uses of assessment

Assessment enables teachers to evaluate their teaching program and plan further learning. It provides the starting point for planning the learning experiences which will support the content to be taught and the literacy skills to be developed. The information gained will indicate which students might require individual programs or further investigation to discover possible learning difficulties. It can provide useful information to assist other teachers in planning to meet the needs of individuals and groups of students.

Assessment information provides students with feedback about their performance and progress and helps them to set further learning goals.

Assessment informs parents and caregivers about students' achievements and progress and enables teachers, parents and students to discuss the goals that have been met and to make plans for further progress.

Collecting information about students' literacy achievements

Teachers of Year 7 should collect information about students' experiences and achievements in literacy and science as a starting point for planning and programming appropriate learning experiences.

Information can be collected from a range of sources including:

- *Students' work*

  Take appropriate opportunities to evaluate students' achievement and use them to make decisions about further support, consolidation or acceleration.

- *Primary schools*

  Assessment of students' prior learning may be aided by contact with primary schools. Information relating to previous learning experiences and student achievement could be collected and passed on to secondary teachers by school literacy teams.

- *The ELLA results*

  Use these as a snapshot of the skills of individual students and the age group in reading, language and writing. They will give you a starting point for planning and programming appropriate activities.

- *Support teachers*

  Find out about students' levels of achievement from ESL teachers, who can provide advice on using the ESL scales as a tool for assessment, as well as for planning and programming.

  The ESL scales support teachers in making judgments about ESL students' achievements and language learning needs.

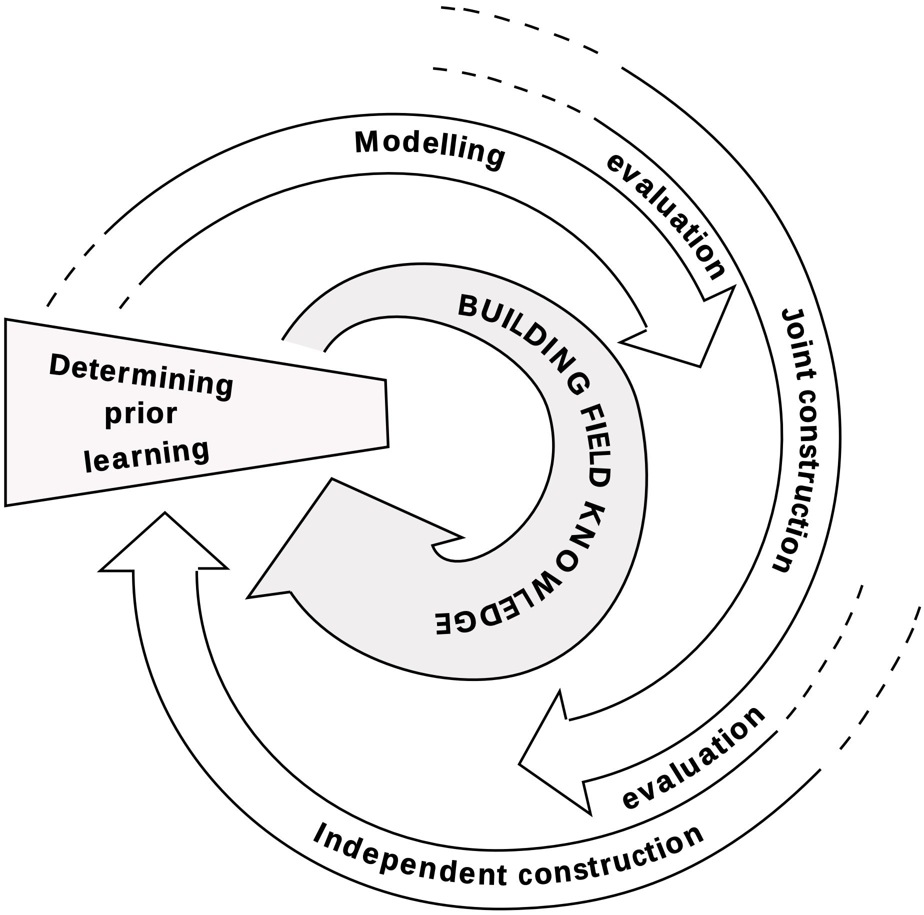
  The ESL scales are a supplement to syllabus documents, and to any curriculum support material, such as teaching units. The ESL scales enable teachers to recognise and articulate the progress their ESL students will make as they develop their proficiency in English.

  It is also important for teachers to use a tool such as the ESL scales to ensure that the second language learners are not incorrectly diagnosed as "failed literacy learners". Problems of second language acquisition may be incorrectly diagnosed as a learning difficulty, which might result in inappropriate or misdirected support.

  Support teachers learning difficulties (STLDs) can provide advice about alternative or additional teaching strategies to assist students experiencing difficulties. They are able to diagnose particular learning difficulties and suggest programs and procedures for addressing students' needs.

Science teaching with an emphasis on building language skills

The following diagram represents **the teaching and learning cycle** used in the science units.



This model continually builds field knowledge. The term *field* refers to the content of the topic, including knowledge and understanding and skills. Activities which build field knowledge include reading, making observations, conducting experiments, class and small group discussion, and viewing of multi-media and the Internet.

The teaching and learning cycle involves:

(a) **Determining prior learning**, where teachers use a variety of ways to find out what prior field knowledge and understanding of language and science students bring into their new Year 7 classes.

(b) **Modelling**, where the teacher and students work with texts which demonstrate the text type on which they are focusing. The teacher and students can deconstruct texts. Give students opportunities to discuss the texts, as this assists them in moving from spoken to written language. Point out such things as the field, the relationship between author and reader, the channel of communication (usually speaking or writing), and the language features and the structure of the text.

During this phase, students will build up a language for analysing and discussing texts which they can apply to other texts of the same type.

(c) **Joint construction**. Students can now begin to construct their own texts because they have gained understanding of the text from the previous phase. They will need to carry out research to build further field knowledge. You can then guide and assist with the construction of the text. Joint construction can be with the whole class, small groups or individuals.

(d) **Independent construction**. You can now allow students to develop their own text. They will need to carry out research for the new writing. Encourage them to discuss their drafts with other students and with you before revising and editing in preparation for publication. It is important to assign fairly small tasks in the initial stages.

Application of the cycle

Teachers move students through the teaching and learning cycle towards developing literacy skills and increasing subject knowledge and understandings. Evaluation of students' progress is continuous throughout the topic. There is much overlap between the modelling, joint construction and independent construction phases of the cycle. This signals the potential need to revisit or oscillate between phases as the students move throughout the cycle.

What information needs to be collected?

1. Collect information about students' current knowledge, skills and understandings of the content area outlined in the Science 7-10 syllabus. Conducting quizzes, brainstorming activities, and making *What we already know* charts, are ways of finding out where to start. These activities will also help you identify students who will require additional support and those who are ready for extension.
2. Information also needs to be collected about students' literacy skills, as these will influence their ability to demonstrate proficiency in the new content. Consider what the literacy demands of the planned work will be. Determine whether students have encountered these sorts of demands before.

   It may be necessary to have students produce a piece of writing, or participate in an oral discussion, or have them read a piece of text to determine what level of support will be required. Think about the technical or subject-specific language which students will be required to use and ways in which they will need to be supported. Examine the texts which students will be required to read, to determine whether they will be too difficult or too simple. It may be necessary to find a range of texts to suit the differing stages of development of the students.

   Students can be supported in reading more difficult texts if you use some of the following strategies:

   – highlighting new vocabulary and teaching it beforehand

   – having students look at the headings and subheadings and predicting what the text will be about

   – having students consider the theme of a text and predict what the contents might be

   – making tapes of the text which students may follow on a listening post.

Explicit teaching involves:

- explaining the purpose of the task or unit of work to students
- explaining how the task or unit of work helps in achieving learning outcomes
- presenting tasks clearly
- providing modelling and demonstrations of the tasks to be performed
- making links with prior knowledge
- providing positive and useful feedback to students both on their developing content knowledge and skills and on their literacy skills
- correcting errors and providing further modelling and demonstration as needed
- providing opportunities for students to practise new skills and understandings with guidance from the teacher or support from their peers.

Systematic teaching involves:

- breaking the learning up into meaningful "chunks"
- having a clear understanding of the skills, knowledge and understandings that need to be taught and an appropriate sequence of activities which will enhance their acquisition by students
- knowing what literacy demands are inherent in the content to be taught
- having the knowledge and confidence to use a range of appropriate strategies for teaching literacy
- monitoring students' progress consistently throughout the learning cycle and adapting the teaching where necessary
- providing opportunities for student observation, guided practice and independent performance of all new learning.

(adapted from *Focus on Literacy,* Department of School Education, 1997, page 16)

The units of work which follow will exemplify a range of strategies for using assessment to inform and influence the teaching program.

Chapter 4: Units of work

Design and use

This chapter contains four units of work as a resource to provide examples of how literacy strategies can support science learning. The aim of the resource is to help you to integrate **the explicit teaching of text types** into existing units of work. Students' understanding and ability to write using these text types will enhance their scientific understanding.

The units, and some resources to support their use, are contained in this chapter.

Why teach text types?

Rarely will a piece of scientific writing present solely as a discrete text type. However, the explicit teaching of text types has a place in assisting students to become better readers and writers of scientific text. By analysing text types, students will be able to understand how they are being positioned by the writer. They will also be able to recognise the language pointers that signal the writer's purpose. This familiarity with text types will, in turn, help them to write more clearly.

Four units of work are presented as models which explicitly incorporate literacy strategies. The units are intended as "ready-to-use" science units, including outcomes relating to knowledge, skills and attitudes in a form with which science teachers will be comfortable. The intention is to demonstrate that including literacy strategies is a powerful step in supporting students' learning. After teaching a unit, you may be able to adapt suitable literacy strategies to other topics in your existing program.

Why four units on water?

Units relating to water have been developed because "Water" is a topic commonly taught in Year 7 or Year 8 science. Alternatively water might be a component of some other unit of work at your school (perhaps a theme or an integrated unit), so only some sections of these units may be applicable.

Certain aspects of a topic lend themselves to certain text types. The following chart shows how different aspects of a study of water were matched to particular text types.

WATER

Properties of water (reports and procedures)	The water cycle (explanations)	Water management (expositions)
• Solubility and solutions • Decomposition with a voltameter • Test for water (copper sulfate etc.) • Water in plants • Water in the human body • Dehydration • Surface tension capillarity • Adhesion/cohesion	• Forms of water • Boil water (in jug)/ freeze water (in freezer) • States of matter • Changes of state (measure temperature and graph) • Properties of water • Model of water cycle • Making clouds • Particle model/changes of state • Water cycle diagram • Distillation of water/ purifying • Purification of water supply	• Testing water quality • Mulching • Water conservation, domestic practices • Irrigation • Algal blooms • Sewage pollution
Units 1 and 2	**Unit 3**	**Unit 4**

Texts which are either read or produced by students for science in Years 7-10 predominantly involve the processes of **describing, instructing, recounting, explaining** and **arguing.** Recounting is mostly associated with recording experiences, e.g. when students are required to recount a field trip. Most students in Year 7 will already be familiar with writing recounts, so these units will focus on less familiar text types in science.

Unit 1 and Unit 2 both deal with the properties of water. A comparison of these two units can be used to demonstrate how similar science content can be used to develop different language skills.

Using the units

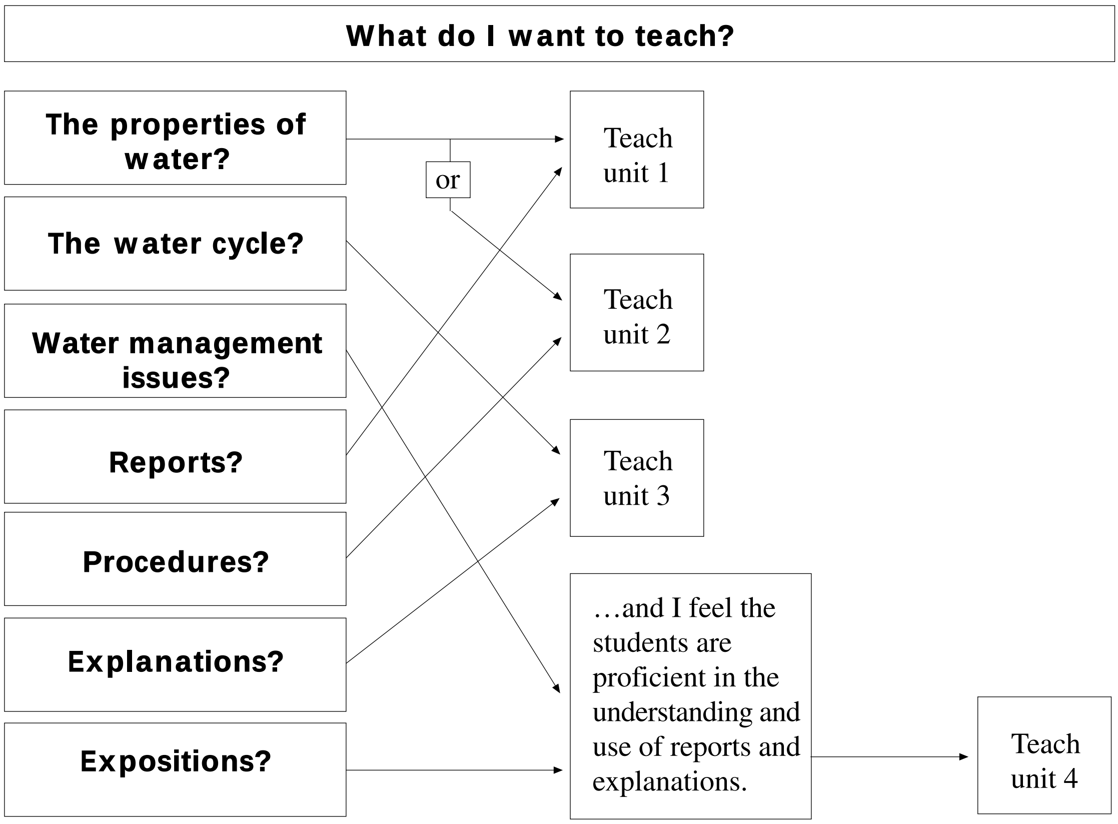
- Try to develop skills in just one text type at a time. Select only one or two of these units for a class, rather than trying to teach them all. Refer to the other units as a source of useful literacy strategies to adapt to other topics.
- It is important to keep the content relatively simple when introducing a text type for the first time.
- The lesson sequence concentrates on providing background and detail for the language activities. It is assumed that science teachers can provide or easily obtain detail for the science content.
- The units as presented are ambitious. Comprehensive units are provided so that a wide range of strategies can be modelled. Select those activities you feel confident to try, given the nature of your class and your local situation.

Structure of the units

Each unit consists of:

Introduction	Including: • Rationale • Learning outcomes • Vocabulary
Unit overview	The overview could be used as a component of your faculty program. Use a copy to help you navigate through the teaching notes. If desired you could tailor the overview to your needs, e.g. by adding further ideas in the resource column or by adding some registration columns.
Map linking learning indicators to outcomes	Use this map when developing your assessment plan. If you are writing a new unit, the use of a map like this will help to ensure that the unit addresses the intended learning outcomes.
Teaching notes	These comprise detailed descriptions and explanations for literacy activities, including annotated examples and solutions, general strategy descriptions and suggestions for assessment.
Resources	**Blackline masters** (BLMs) for worksheets and overhead transparencies (OHTs) are included. Depending on how you organise a particular lesson, you may need **class sets, group sets** or **OHTs**. Note that some BLMs can be collected and used again with another class.

The following may assist you in selecting the most appropriate unit for your class.



Unit one: Properties of water/Reports

Text type focus: Report

Introduction

Rationale

This unit focuses on writing descriptions in a report. It begins with the modelling and deconstruction of reports as well as identifying the purpose of report writing.

This unit highlights:

- the recognition of organisational elements and the use of the present tense;
- the appropriate use of technical terms and verbs; and
- the use of preview sentences in paragraphs.

Explicitly recognising and identifying structures and language features will assist students to understand and respond appropriately when listening to or reading reports and will help them to write successful descriptive reports.

This approach will support effective learning arising from the investigation of some important properties of water, its detection and its composition.

The aims of the unit are:

- to investigate some of the important properties of water, its detection and its composition
- to use descriptive information in the form of reports.

Learning outcomes

Students will be able to:

- write descriptions of aspects of water in a report (Literacy)
- extract information from a variety of sources (Science 7-10)
- present information and ideas in short written and oral reports (Science 7-10)
- recall relevant concepts, ideas, theories and laws explaining scientific aspects of situations and problems (Science 7-10)
- manipulate simple laboratory and field apparatus and other equipment commonly available in a school (Science 7-10)
- speak clearly and confidently with each other (Science 7-10)
- work effectively in groups (Science 7-10).

Vocabulary

description, noun, verb, observation, decomposition, voltameter, soluble, solution, solvent, solute, hydrogen, oxygen, hydration, dehydration, anhydrous, transpiration, photosynthesis, adaptation, absorb, absorbent, absorbency, adhesion, cohesion, meniscus, detection.

Overview

Page 1 of 3

Unit 1: Properties of water/Reports					Text type: Report
Phase of the teaching/learning cycle	**Learning activity**	**Language emphasis**	**Resources**	**Learning indicators** Students can:	**Assessment suggestions**
Determining prior learning	Activity 1. Mind mapping water. • Individual and group construction of mind maps	• building vocabulary	BLM 1.1	• recall the appearance, some common uses and occurrence of water in nature	• Quiz • Teacher observation
Modelling	Activity 2. Deconstructing a report. • Teacher-led discussion of the structure and purpose of reports. Analyse a report text entitled "Water around us". • Class, group or individual construction of a mind map (Extension).	• deconstructing a model report • paragraph construction • use of technical terms • structure of a report • use of present tense	BLM 1.2 BLM 1.3	• state the purpose and structure of a report • use a mind map to analyse a description of the appearance, uses and occurrence of water	• Teacher observation
	Activity 3. Writing a report about the voltameter. • Teacher demonstration of the decomposition of water. • Student construction of a description of a voltameter using a report scaffold.	• technical terms • spelling • reading and writing texts which include diagrams	BLM 1.4 BLM 1.5	• make accurate observations • record observations accurately • describe the decomposition of water • contribute to the joint construction of a report	• Scaffold presentation
	Activity 4. Solubility. 4a: Solubility of iodine. • Teacher demonstration of the solubility of iodine in different solvents. • Teacher-led discussion leading to the definition of solubility terms. • Student development of vocabulary list and student spelling practice 4b: Solubility of common solids. • Student experimentation to test the solubility of common solids in water.	• use of technical terms		• demonstrate the correct usage of the terms *solution*, *solute*, *solvent*, *soluble* and *insoluble* • give examples of substances which are either soluble or insoluble in water • give examples of solutes and solvents • spell technical terms correctly	• Written test • Written test • Spelling quiz

NEALS

Unit 1: Properties of water/Reports — **Text type: Report**

Phase of the teaching/learning cycle	Learning activity	Language emphasis	Resources	Learning indicators Students can:	Assessment suggestions
Modelling (continued)	Activity 5. Analysing the report "*Solutions*" • Student analysis and reconstruction of a model report	• paragraphing • use of preview sentences • use of technical terms • optional: subject-verb agreement	BLM 1.6a BLM 1.6b BLM 2.4 BLM 1.7a BLM 1.7b	• state the purpose and value of technical terms • state the tense of a report text • reconstruct a jumbled report	• Written test • Teacher observation of BLMs
	Activity 6. Water in living things. 6a: Heat on copper sulfate (optional). • Student investigation to test for the presence of water in food.	• use of technical terms		• make a simple test for water using crystalline copper sulfate • demonstrate the correct usage of the terms *dehydrated, hydrated* and *anhydrous*	• Design of experiment to test for water in food • Written test • Teacher observation
	6b: Using the beam balance. • Student activity to measure mass of food samples.			• use a multibeam balance for weighing	
	6c: Investigating water in plants. • Students experiments to investigate the movement of water in plants.			• state that water moves from roots, through stem in xylem vessels to the leaves, where it is lost in transpiration	
	• Student activity to determine the percentage of water uptake of dried peas (optional).			• calculate the percentage of water uptake in dried peas	
	6d: Report on water in plants. • Student sequencing exercise to produce a report on movement of water in plants.	• structure of report text • editing	BLM 1.8a BLM 1.8b	• describe how water moves through plants, how it is used and adaptations to conserve it	• Completion of report on water in plants

Page 3 of 3

Unit 1: Properties of water/Reports | **Text type: Report**

Phase of the teaching/learning cycle	Learning activity	Language emphasis	Resources	Learning indicators Students can:	Assessment suggestions
Joint construction	Activity 7: Writing a class report. • Student experiments to investigate surface tension or capillarity. • Either: 1. Teacher-led class construction of report or 2. Jigsaw activity to assist students to write own reports	• Written sentences from oral descriptions	BLM 1.9 BLM 1.10 BLM 1.11	• make accurate observations • record observations accurately • write descriptive sentences • contribute to a joint construction of a report text entitled *Some properties of water*	• Construction of paragraphs • Construction of report text
Independent construction	Activity 8: Writing a report. • Student drafting, editing and presentation of report	• Reading • Extracting information • Drafting and editing • Writing a descriptive report	BLM 1.12a BLM 1.12b BLM 1.13 Assessment criteria	• extract information about water and the human body from text • write an effective report entitled *Water in the human body*	• Observation of notes • Final presentation of text. See assessment grid. • Self assessment

Map linking learning indicators to outcomes

This map can be used to assist you in determining the extent to which students have achieved outcomes in the Science 7-10 syllabus and in literacy .

Unit 1: Properties of water/Reports	**Text type: Report**
Learning outcomes Students will be able to:	**Learning indicators** Students can:
write descriptions of aspects of water in the report text type. (Literacy) *and* present information and ideas in short written and oral reports (Science 7-10)	• state the purpose and structure of a report • record observations accurately • describe the decomposition of water • contribute to the joint construction of a report • state the purpose and value of technical terms • state the tense of a report • reconstruct a jumbled report • describe how water moves through plants, how it is used and adaptations to conserve it • write descriptive sentences • contribute to a joint construction of a report text entitled *Some properties of water* • write an effective report entitled *Water in the human body*
recall relevant concepts, ideas, theories and laws explaining scientific aspects of situations and problems (Science 7-10)	• recall the appearance, some common uses and occurrence of water in nature • demonstrate the correct usage of the terms *solution, solute, solvent, soluble* and *insoluble* • give examples of substances which are either soluble or insoluble in water and give examples of solutes and solvents • spell technical terms correctly • demonstrate the correct usage of the terms *dehydrated, hydrated* and *anhydrous* • state that water moves from roots, through the stem in xylem vessels to the leaves, where it is lost in transpiration
manipulate simple laboratory and field apparatus and other equipment commonly available in a school (Science 7-10)	• make accurate observations • make a simple test for water using crystalline copper sulfate • use a multibeam balance for weighing • calculate the percentage of water uptake in dried peas • make accurate observations • record observations accurately
extract information from a variety of sources (Science 7-10)	• use a mind map to analyse a description of the appearance, uses and occurrence of water • extract information about water and the human body from text
speak clearly and confidently with each other (Science 7-10) *and* work effectively in groups (Science 7-10)	• speak clearly and confidently with other students in their group • contribute to a group task • work effectively with a partner to complete a task • accept roles and complete tasks within a group

Teaching notes

Phase 1: Determining prior learning

During this phase, students share prior knowledge, clarify ideas by building a mind map and seek definitions or explanations of any new terms. Observe students' understanding and use the information to plan future learning activities.

Activity 1

Mind mapping water

*Purpose: to introduce the *field, to ascertain prior learning, to encourage non-threatening group interaction and to share group knowledge.*

**Field: a literacy term which refers to the content of the topic.*

- Instruct students on how to complete a mind map.

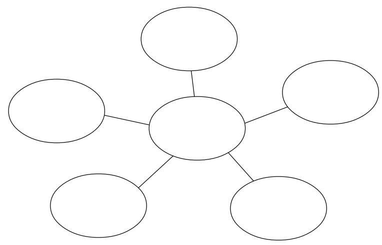
Point out its usefulness as a starting point for thinking and writing, i.e. it allows the collection and sorting of ideas without the need to write meaningful sentences immediately. Remind students they may add more circles to their map.

- Students use BLM 1.1 individually to record their field knowledge.

This will be used to help students contribute to the next step. Later it can be pasted into their notebooks as a record for you to examine and for them to modify during the unit.

- Students form groups of 3 or 4 to share and modify their ideas for key words and phrases on the mind map and to brainstorm more ideas about water.
- Supply each group with an extra copy of BLM 1.1.
- Students construct a group mind map by writing ideas on the mind map scaffold (BLM 1.1)
- Students display and describe their mind maps and compare them with those from other groups in the same class.
- Refer to the individual and group mind maps to determine the prior learning of students about water and to evaluate the suitability of the unit plan.

Strategy: Mind map



A mind map is a visual-verbal or structured overview of a concept or topic. The information may be in the form of words or drawings. Mind mapping can be used as an introduction to analysing a report and it gives the students the opportunity to predict the vocabulary and the ideas mentioned in the report. It can assist students to classify and group ideas in preparation for reading. A similar strategy could be used as preparation for students constructing their own report if they were familiar with this text type.

Phase 2: Modelling

The purpose of this phase is to assist students to recognise the structures and features of the report text type by analysing, or deconstructing, model reports. At the same time students will build field knowledge about the composition of water and solubility.

Activity 2

Deconstructing a report

Purpose: to show the parts and features of reports, to show the purposes of paragraphs, and to model how to use words in sentences.

- Distribute a copy of BLM 1.2 containing the report entitled *Water around us*.
- Students read the report individually.
- Discuss with the class the structure and purpose of paragraphing.

Useful questions you might ask to lead discussion: *How many paragraphs are there? What do they tell you? Why is there not one long paragraph? Which paragraphs are similar and can be grouped together?*

- Students answer the questions on BLM 1.2. (Answers on BLM 1.3.)

When students answer these questions they are analysing a report.

The text is divided into two main parts. The first is an introductory paragraph which is called a general statement *or* classification. *This is followed by paragraphs which describe different aspects of water. These are referred to as the* description. *The introductory mind map activity required students to classify their ideas into these different groupings, and students now need to recognise that similar information is grouped together in each paragraph.*

In this example, the descriptions are of the appearance of water, where it is found and how it is used. Reports on other topics will also have this format, but the type of description used in each paragraph will vary with the topic.

Reports are written in the present tense and they usually contain technical words. Because this is at the beginning of a topic, the technical language is very simple e.g. "solid", "liquid" *and* "gas" *and has not been highlighted in this example.*

The paragraphs about where water is found and how it is used both begin with a sentence (underlined on BLM 1.3) which previews the information in the paragraph.

Extension

- Students make a mind map based on the report. (This could be with the class, with a group or individually.)

Text type: Report

Reports are essentially descriptions that classify and describe things in general and specific terms.

Structure of reports

Reports are frequently structured in the following way:

Classification

This section of the text classifies the thing being described, locates it in time and space and/or previews the rest of the description to follow.

Description

Feature 1
Feature 2
Feature 3
etc.

Typically, the description will consist of paragraphs, each dealing with a different feature.

Verbs

Verbs used in the classification are more likely to be **linking verbs** such as *is, has, become*. Verbs used in the description are more likely to be **action verbs** such as *occurs, called, makes.*

Activity 3

Writing a report about the voltameter

Purpose: to model the construction of a report.

- Demonstrate the decomposition of water by running electricity through a solution of dilute sulfuric acid in a voltameter until gas has been produced.

> If your voltameter is of a different design, discuss the design of the voltameter and compare it with the diagram of the voltameter on BLM 1.4.

- Collect each gas in a separate test tube. Demonstrate the test for each gas with a taper or splint.
- Students answer questions about the experiment on BLM 1.4.
- Students draw and label a 2-D diagram of the voltameter in the space provided on BLM 1.5.

> The experiment on the decomposition of water is recorded by students in a report format (BLM 1.5). The classification is already given. The description of the appearance of the voltameter is best provided by students drawing a 2-D diagram and labelling it. It is important for students to realise that labelled diagrams can often be an effective way of providing a description. The observations made during the experiment are also a description.

- Prepare students to complete BLM 1.5 by asking for vocabulary which could be used to write a report. Make sure some technical words are included.
- Discuss with students the tense to be used in writing the description of their observations.
- Write the report together with the class.

> Get the students to suggest what to write. If students find it difficult to suggest what to write, start some sentences on the board and let the students complete them. Under your guidance, those sentences are improved and finally written on the board.

- Students complete the report on BLM 1.5.

> **Use of tense**
>
> *The **report** text type is used for students to record their observations from the demonstration. This requires students to use the present tense, which generalises the observations rather than making them specific to one experience, as in a **recount**.*

Activity 4

Solubility

Purpose: This activity is designed primarily to build field knowledge and to provide experiences so students can complete the joint construction "Solutions" in Activity 5. The value of the use of technical language is demonstrated.

Activity 4a: Solubility of iodine

- Demonstrate the varying solubility of a small amount of iodine in three different solvents: firstly water, then methylated spirits and finally an organic solvent like cyclohexane.

Safety caution: Cyclohexane and iodine must not be handled by students.

ANSWER: Iodine is partially soluble in water and produces a light brown colour. In methylated spirits, it forms a brown solution and in cyclohexane it produces a violet colour.

- Define the terms *solute, solvent, solution, soluble* and *solubility* as this activity is demonstrated.
- Make a spelling list of words introduced in this topic and ask students to learn them using the sequence: LOOK, SAY, COVER, WRITE, CHECK.

Strategy: Spelling

"LOOK-SAY-COVER-WRITE-CHECK" This strategy enables students to use the visual, auditory and kinaesthetic memory systems to recognise and recall accurate spelling.

Students should also be shown how base words can be used to provide clues for spelling and meaning, e.g. solute, soluble, solution, solvent. Demonstrate how word elements, such as "hydra" can be used to build other words and as clues to meanings, e.g. hydration, dehydration, anhydrous.

Activity 4b: Solubility of common solids

- Students perform an experiment to test the solubility of a variety of solids in water e.g. chalk powder, copper carbonate, copper sulfate, sugar, sulfur, and table salt.

Option/homework

- Students write a report using a scaffold such as the one below.

Solubility of common solids

Classification

Solubility is…

Description

-
-
-

Activity 5

Analysing the report *Solutions*

Purpose: This activity illustrates the classification of information and grouping of related information in paragraphs. Verbs are circled and the technical words are boxed in the annotated version below. The meaning of technical words should be reinforced.

- Students, in groups or individually, analyse the report *Solutions* by reading and completing BLM 1.6a and BLM 1.6b. Students are required to match a preview sentence with the rest of the information provided to construct paragraphs.
- Point out to students that often a technical word cannot be replaced by one single word. Once its meaning is understood, the use of a technical word can result in information being conveyed in a much more concise form.

Group work: How can it be used effectively?

Student talk in small groups provides opportunities for them to connect past and present experiences and make sense of new information.

This is less threatening than having to commit themselves in front of the whole class or in writing.

Talk in groups has the potential to engage more students than whole-class discussion. Talk about the topic in groups will also allow students to learn from each other. Talk about ideas is a precursor to effective writing about the ideas.

To make group work effective

Ensure students are clearly aware of the tasks and expected outcomes. Setting time guidelines will provide a little positive stress to assist the group stay on task.

Note:

A second version of this activity (BLM 1.7a and 1.7b) is supplied. This might be more useful for students who come from a non-English speaking background. In this version, students have to match the subject of the sentence (who or what is doing something) with the verb (what is happening, what is being done). This is called subject-verb agreement.

- Use BLM 2.4 as an OHT to demonstrate technical words and verbs.

Annotations for BLM 2.4: Solutions

A solution is a mixture. It is obtained by dissolving one substance in another, for example by stirring sugar into water.

A solution contains a solute and a solvent. *The liquid which is used to make the solution is called the solvent. The solid which dissolves is called the solute.*

Water is the solvent which is most often used to make solutions. *It makes up about 65% of blood and is important because it carries dissolved substances such as simple foods, vitamins and minerals around the body. It is used as a solvent for some paints which are said to be water soluble.*

Other liquids also are used as solvents. *Methylated spirits is a good solvent for some inks. Dry cleaning fluid works well to dissolve stains which contain fat. Mineral turpentine is suitable for dissolving paints which are not water soluble.*

Technical word	Meaning
solvent	liquid used to dissolve substances
solute	any solid which dissolves in a liquid
solution	a mixture of a dissolved solid and a liquid

Note: The report is written in the present tense.

Phase 3: Joint construction

Students will be supported in writing effective reports in this phase. Students will further develop experimental skills and techniques, and increase their understanding of concepts as they investigate the water in living things.

Activity 6

Water in living things

Purpose: This activity will develop field knowledge in order to complete a report on water in plants as a joint construction.

Activity 6a: Heat on copper sulfate (OPTIONAL)

- Students investigate the effect of heat on copper sulfate and then use anhydrous copper sulfate to test for the presence of water in food.
- Define the terms *dehydrated, hydrated* and *anhydrous*.
- Students add the new words to their spelling list.

Activity 6b: Using the beam balance

This activity may be useful if students are not competent in the use of the beam balance.

- Demonstrate the use of a multiple beam balance to weigh objects.

Alternative activity

Refer to Unit 2, Activity 9, page 69.

- Students summarise a list of instructions as preparation for the following experiment.

Alternative activity

Refer to Unit 2, Activity 10, page 69.

Activity 6c: Investigating water in plants

- Supply textbook references for students to use in carrying out their experiments.
- Students set up experiments to show:

  (i) transpiration e.g. by placing plastic bags over plants

  (ii) movement of coloured water through a celery stem.

OPTIONAL

- Students perform an experiment to determine the weight of water absorbed by a sample of dried peas and express this amount of water as a percentage of the total weight of the peas.

Activity 6d: Report on water in plants

- Direct students to complete BLM 1.8a and 1.8b. This can be in groups or individually.
- Students complete a report entitled *Water in plants* by following the instructions on BLM 1.8a.

This is an opportunity for students to use a word processor to edit text. Produce the worksheet on a disk for students to use. Then, rather than underline, they can colour the sentences.

Answer for BLM 1.8

Like all living things, plants are made up mostly of water. They need water to carry out important life processes and they must have special adaptations to obtain water.

Description (occurrence)

Every part of a plant needs water. Plants absorb water through roots. Water then moves up the stem through special tissue called xylem. It then moves into the leaf. Water vapour can escape from pores in the leaf in a process called transpiration.

Description (use)

Plants have many uses for water. They use the sun's energy, carbon dioxide and water to make sugars in a process called photosynthesis. Plants also use water to carry dissolved sugars from the leaves to the rest of the plant.

Description (adaptations of plants in dry areas)

Plants which survive in very dry areas must have special adaptations. They often have very extensive root systems. They may also have very tiny leaves like spikes to reduce water loss or they may store water.

Activity 7

Writing a class report

Purpose: to provide guidance and support as students begin to write reports.

- Allocate one of the following simple experiments to different groups around the class: Surface tension causes a meniscus (BLM 1.9), Detergent and surface tension (BLM 1.10) and Capillary movement (BLM 1.11).
- Students carry out the experiment and then write the results in draft form.
- Use one of the following approaches (depending on the progress of the class):
  1. After having a student from each group give an oral report about their experiment, write a report on *Some properties of water* together with the class. Use each group's summaries as new descriptive paragraphs.
  2. Use the **expert groups** strategy to organise groups of three students to perform one of the three experiments and write their results in draft form. Then new groups of three students are formed so that each new group has one student from each experiment as a member. These new groups of three now write a report on *Some properties of water*, using the information each member has collected.

Strategy: Expert groups

*In an expert group or **jigsaw** activity, students are allocated to different groups to gather information on different aspects of a topic. Each member of the group becomes an "expert" on that group's activity or topic. New groups are then formed, each with an expert from all the original groups, so that they may all contribute to the final activity.*

Phase 4: Independent construction

Students will demonstrate their ability to write an effective report in a new but related context. This new context provides the opportunity to further build field knowledge.

Activity 8

Writing a report

Purpose: to enable students to apply their literacy skills in a different field with reduced support from the teacher.

- Students, using extracts from textbooks (given on BLM 1.12a and BLM 1.12b), produce a descriptive report entitled *Water in the human body*.
- Describe and clarify the task and provide students with BLMs, text extracts and the assessment criteria.

Task assessment criteria

Student's name: ....

Feature of report	**sometimes**	**usually**
present tense		
sentences grouped		
paragraphs used		
"classification" present		
"description – amount" present		
"description – use" present		
"description – loss" present		
science content accurate		

- Students use the scaffold (BLM 1.13) to write in their notes while reading from textbook extracts.

This is an opportunity for students to use a word processor to edit text.

- Students individually produce a draft report using a scaffold (BLM 1.13).
- Students edit the draft and then have it checked by a peer, before the final presentation.
- Use the grid above to assess independent constructions.

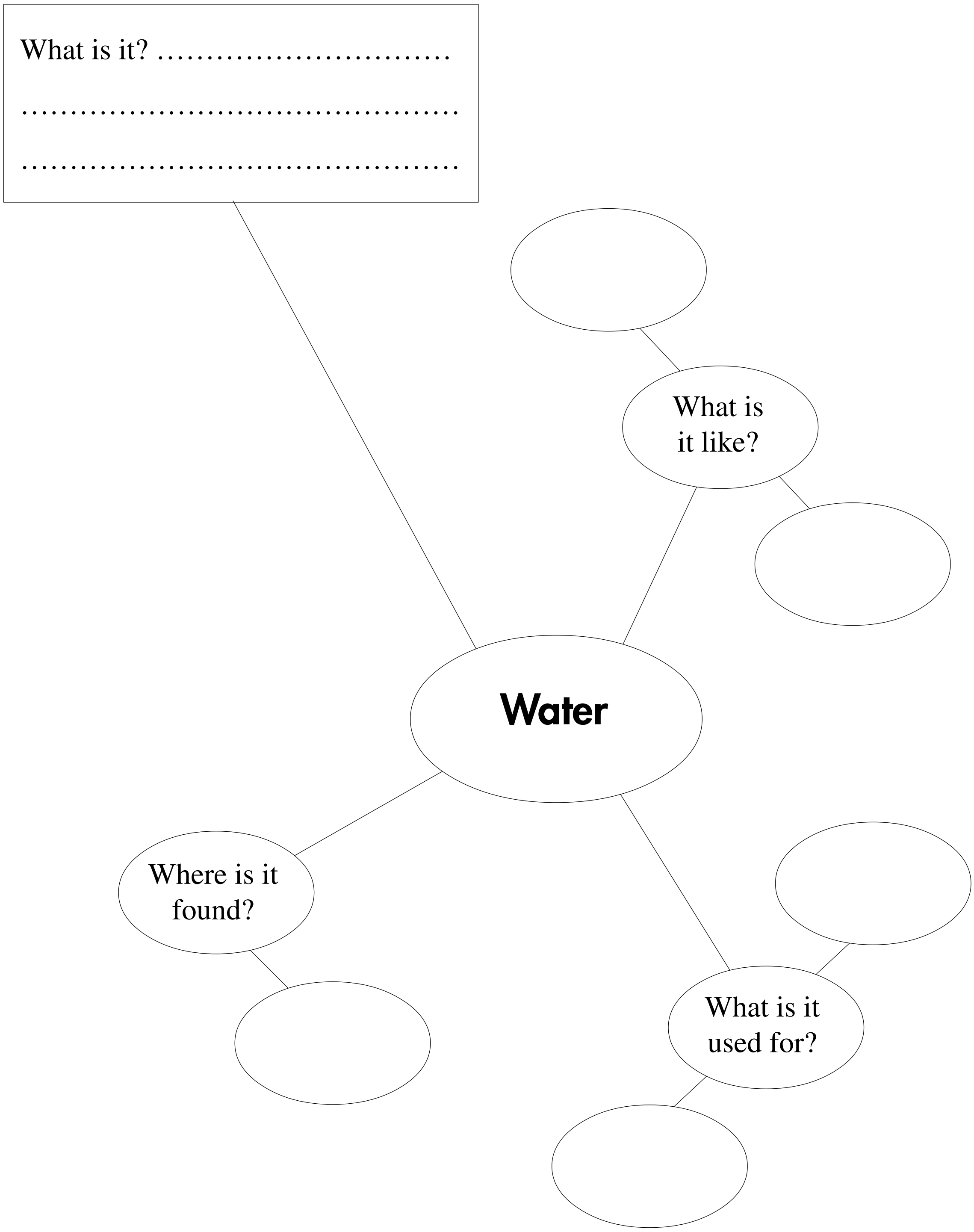
Self assessment

Encourage students to:

- *be aware of assessment criteria*
- *self assess and evaluate their own progress*
- *compare their assessment with that of the teacher.*

Mind map

Mind map completed by: ....



BLM 1.2 Report worksheet

Water around us

.... Water is a naturally occurring substance. It has special properties which make it very important to life.

.... Water is colourless, odourless and tasteless in its pure form. Most water on Earth is in the liquid state, but it also may occur as a solid called *ice* and as a gas called *water vapour*.

.... Water occurs in many places on Earth. The total amount of water on Earth is about 1.5 million million million litres. About 97% of this is found in the oceans as salt water. Another 2% occurs in frozen form, mostly in glaciers and in the polar ice caps. The remaining 1% is underground, in lakes and rivers, and in the atmosphere.

.... Water is very important to people and has many uses. It makes up about 65% of the human body. Water is used up in our bodies, so we need to drink at least 2 litres of water each day. In the home, water is used for cooking, cleaning and washing. It is drunk also by animals and used to grow plants in home gardens and on farms. In industry it is used for such purposes as cooling machines, transporting goods and making electricity.

1. Why did someone write this text?

   ....

   ....

2. Who wrote the text and for whom?

   ....

   ....

3. The first paragraph is a general statement that introduces what is to be described. Label it as *Classification*. The next three paragraphs describe different aspects of water. Match each of the following labels to the other paragraphs and write them on the lines provided above:

   Description – uses   *Description – appearance*   *Description – occurrence*

4. The verbs in paragraph 1 have been circled. Circle the verbs in the other paragraphs.

   What tense are they? ....

5. A paragraph often begins with a sentence which previews the rest of the information written in that paragraph. Underline the sentence which previews the rest of a paragraph.

BLM 1.3 Report worksheet – answer to BLM 1.2

Water around us (answer sheet)

Classification	Water is a naturally occurring substance. It has special properties which make it very important to life.
Description – appearance	Water is colourless, odourless and tasteless in its pure form. Most water on Earth is in the liquid state, but it also may occur as a solid called *ice* and as a gas called *water vapour*.
Description – occurrence	Water occurs in many places on Earth. The total amount of water on Earth is about 1.5 million million million litres. About 97% of this is found in the oceans as salt water. Another 2% occurs in frozen form, mostly in glaciers and in the polar ice caps. The remaining 1% is underground, in lakes and rivers, and in the atmosphere.
Description – uses	Water is very important to people and has many uses. It makes up about 65% of the human body. Water is used up in our bodies, so we need to drink at least 2 litres of water each day. In the home, water is used for cooking, cleaning and washing. It is drunk also by animals and used to grow plants in home gardens and on farms. In industry it is used for such purposes as cooling machines, transporting goods and making electricity.

Note: Preview sentences are underlined.

1. Why did someone write this text?

   To give information about water by telling what it is like, where it is found and how it is used by people.

2. Who wrote the text and for whom?

   A textbook author wrote this for students. Someone who knew about the topic wrote it for those not knowing.

3. The first paragraph is a general statement that introduces what is to be described. Label it as *Classification*. The next three paragraphs describe different aspects of water. Match each of the following labels to the other paragraphs and write them on the lines provided above:

   Description – uses   *Description – appearance*   *Description – occurrence*

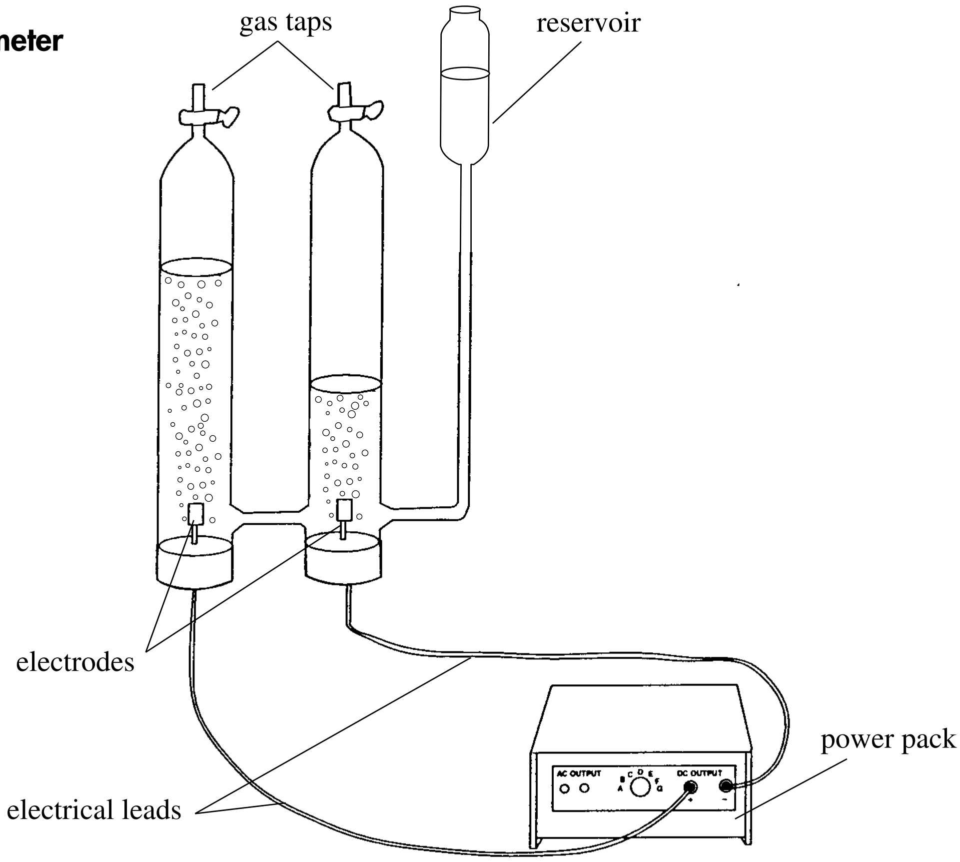
4. The verbs in paragraph 1 have been circled. Circle the verbs in the other paragraphs.

   What tense are they? *Reports are written in the present tense.*

5. A paragraph often begins with a sentence which previews the rest of the information written in that paragraph. Underline the sentence which previews the rest of a paragraph.

Decomposing water

Diagram of voltameter apparatus



Questions

1. How can we test for the presence of oxygen? Describe a positive result.

 ....

 ....

2. How can we test for the presence of hydrogen? Describe a positive result.

 ....

 ....

3. In this experiment, electricity is used to break up water particles into two simpler substances. This type of reaction is called the *decomposition of water* and can be summarised using a word equation. Complete the following:

 water + electrical energy → .... + ...

4. Does water decompose when it is boiled in an electric jug?

 Give a reason for your answer.

 ....

 How could you test this? In your notebook, design an experiment which checks whether boiling some water will decompose it.

BLM 1.5: Report scaffold

A report about the voltameter

Complete a report on the voltameter by filling in the scaffold below

The voltameter

Classification:

The voltameter is a piece of scientific equipment which uses an electric current to decompose water into two separate gases: hydrogen and oxygen.

Description – appearance:

Make a labelled scientific diagram of the voltameter.

Write what it looks like and what it is made of.

Description – use:

Write about what it is used for, how it is used, what happens while it is working.

The voltameter is used for ...

It works by ...

While it is working it ...

Sorting paragraphs

On BLM 1.6b, under the heading *Solutions*, is an incomplete report.

The first paragraph, called the *classification*, is complete. The next three paragraphs are incomplete *descriptions*.

The first sentence of each of these paragraphs is given. When complete, each of the paragraphs will have this beginning sentence followed by related information. Remember, the first sentence previews the rest of the information.

1. Complete the report by cutting out the boxes of text at the bottom of BLM 1.6b and pasting them into the correct spaces to make complete paragraphs.

2. Underline technical words in this report. Choose and write into the table provided the technical words which match the statements given in the *Meaning* column:

Technical word	Meaning
	liquid used to dissolve substances
	any solid which dissolves in a liquid
	a mixture of a dissolved solid and a liquid

3. Circle the verbs in the report. In the space provided rewrite the second paragraph in the past tense by changing the verbs (e.g. "Methylated spirits is a good solvent" becomes "Methylated spirits worked well as a solvent".)

   ....

   ....

   ....

   ....

4. Discuss with your class which tense is more appropriate for a report.

BLM 1.6b: Solutions (version 1)

Sorting paragraphs

Solutions

A solution is a mixture. It is obtained by dissolving one substance in another, for example by stirring sugar into water.

A solution contains a solute and a solvent.

Water is the solvent which is most often used to make solutions.

Other liquids also are used as solvents.

Methylated spirits is a good solvent for some inks. Dry cleaning fluid works well to dissolve stains which contain fat. Mineral turpentine is suitable for dissolving paints which are not water soluble.

The liquid which is used to make the solution is called the *solvent*. The solid which dissolves is called the *solute* .

It makes up about 65% of blood and is important because it carries dissolved substances such as simple foods, vitamins and minerals around the body. It is used as a solvent for some paints which are said to be water soluble.

Sorting paragraphs

On BLM 1.7b, is a scaffold for a report, *Solutions*.

1. Complete all the sentences on BLM 1.7b by selecting the most appropriate verb from the two given and writing it in the space provided, e.g. ...are...... (is/are).

2. The first paragraph in the report, called the *classification*, is complete. The next three paragraphs are *descriptions*. Each of these paragraphs begins with a sentence which is a preview of the rest of the information. Complete the report by cutting out the boxes of text at the bottom of BLM 1.7b and pasting them into the correct spaces to make complete paragraphs.

3. Underline the technical words in the report. Choose and write the ones which match the statements in the table provided below.

Technical word	Meaning
	liquid used to dissolve substances
	any solid which dissolves in a liquid
	a mixture of a dissolved solid and a liquid

BLM 1.7b: Solutions (version 2)

Sorting paragraphs

Solutions

A solution ……… (is/was) a mixture. It is obtained by dissolving one substance in another, for example by stirring sugar into water.

A solution ……………… (contains/contain) a solute and a solvent.

Water is the solvent which is most often used to make solutions.

Other liquids also are used as solvents.

Methylated spirits ……… (is/are) a good solvent for some inks. Dry cleaning fluid ………… (works/work) well to dissolve stains which …………… (contains/contains) fat. Mineral turpentine ……… (is/are) suitable for dissolving paints which ……… (is/are) not water soluble.

The liquid which ……… (is/are) used to make the solution ……… (is/are) called the *solvent*. The solid which dissolves ……… (is/are) called the *solute* .

It ………… (makes/make) up about 65% of blood and ……… (is/are) important because it …………… (carries/carry) dissolved substances such as simple foods, vitamins and minerals around the body to where they ……… (is/are) needed. It is used as a solvent for some paints which are said to be water soluble.

Water in plants

Instructions:

1. Read through the following lists of sentences, which can be used to construct a description of how plants use water.

   It then moves into the leaf.

   Plants absorb water through roots.

   Plants have many uses for water.

   Plants which survive in very dry areas must have special adaptations.

   Every part of a plant needs water.

   They use the sun's energy, carbon dioxide and water to make sugars in a process called *photosynthesis*.

   Water vapour can escape from pores in the leaf in a process called *transpiration.*

   They may also have very tiny leaves, like spikes, to reduce water loss or they may store water.

   They often have extensive root systems.

   Plants also use water to carry dissolved sugars from the leaves to the rest of the plant.

   Water then moves up the stem through special tissue called xylem.

2. Underline in blue any sentence which describes the parts of plants where water is found or where it moves.
3. Underline in red any sentence which describes how water is used by plants.
4. Underline in black any sentence which describes features of plants that help them to live in very dry environments where water is scarce.
5. Choose and circle a sentence which could be placed at the beginning of each paragraph as a preview.
6. Rewrite all sentences into the scaffold on BLM 1.8b in order to produce a report.

BLM 1.8b: Report on water in plants

Water in plants

Classification:

Like all living things, plants are made up mostly of water. They need water to carry out important life processes and they must have special adaptations to obtain water.

Description (occurrence)

....

....

....

....

....

....

Description (use)

....

....

....

....

....

....

Description (adaptations of plants in dry areas)

....

....

....

....

....

....

Surface tension causes a meniscus

Liquids are made up of countless particles. The particles pull together from all directions. At the surface of the water, particles are pulling together strongly. The liquid behaves as though it were surrounded by a very thin and stretchy plastic skin. This “skin” is caused by surface tension. The curved surface of a liquid in a container is called the *meniscus*.

Activity: Meniscus

Aim:

To observe the meniscus of different liquids.

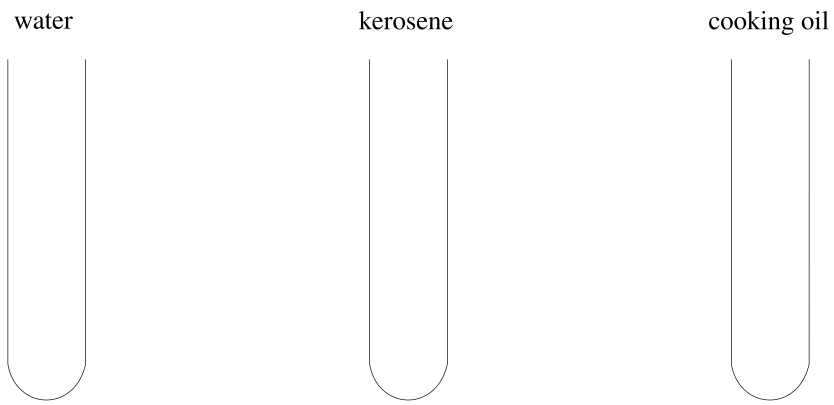
Equipment:

three thin test tubes
water
kerosene
cooking oil

Method:

1. Pour a small amount of water into the first test tube (about 2cm deep).
2. Pour an equal amount of kerosene into the second test tube.
3. Pour an equal amount of cooking oil into the third test tube.
4. Observe the top of each liquid where it comes into contact with the glass.
5. Draw the shape of the surface of each liquid in each test tube.

Result:



Discussion:

Which liquids are made up of particles that stick to glass well?

....

....

Which liquid is made up of particles that stick to each other better than they stick to the glass?

....

....

BLM 1.10: Experiment worksheet

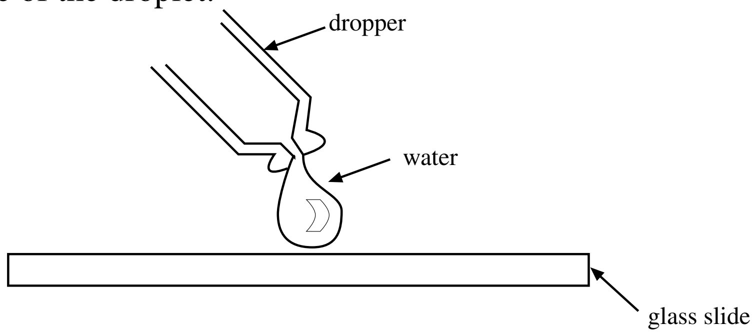
Detergent and surface tension

Liquids are made up of countless particles. The particles pull together in all directions. At the surface of the water, particles are pulling together strongly. The liquid behaves as though it were surrounded by very thin and stretchy plastic skin. This "skin" is caused by surface tension.

You will need:

microscope slide – clean and dry	Petri dish
eye dropper	toothpicks or matches
coloured water	detergent.

1. Use an eye dropper to carefully place a drop of coloured water onto the slide. Observe the shape of the droplet.



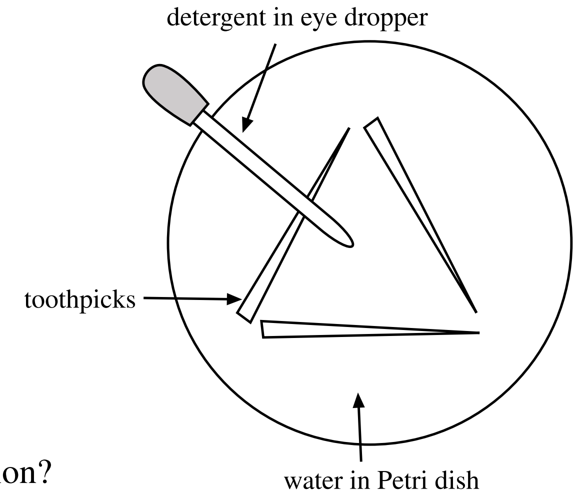
2. Repeat step 1 by using water containing a little detergent.

   What is the effect of adding detergent to water?

   ....

   You can test the droplets on other surfaces if you wish.

3. Place a Petri dish on the bench and two thirds fill it with water. Arrange three toothpicks or matches in the form of a triangle so they float in the centre of the water. Carefully place one drop of detergent in the middle of the triangle.



Observe what happens.

What does this demonstrate about surface tension?

....

....

....

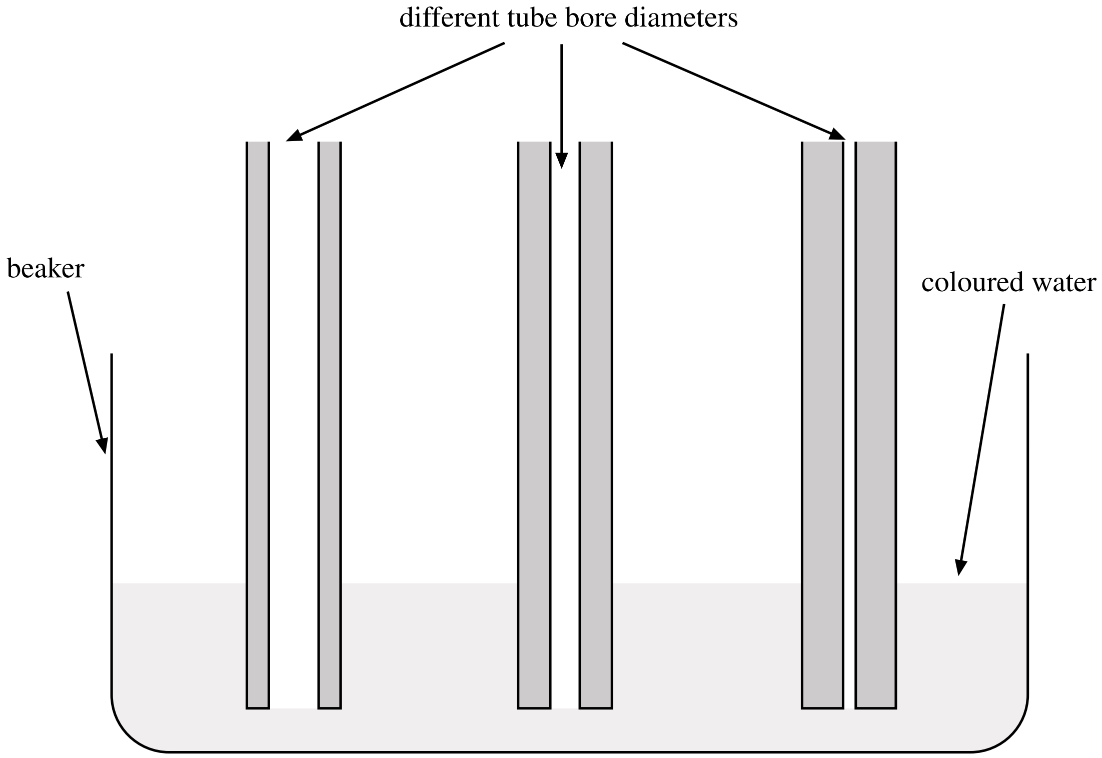
Adapted from *Science Works 1*, Geoff Watson.

Capillary movement

Capillaries are very fine tubes. Water can climb glass capillary tubes by sticking to the sides of the glass.

You will need: coloured water
capillary glass tubes (about the same length but three different bores)
beaker

1. Stand the tubes in the beaker and observe how high the water rises up each tube.
2. On the diagram below show how high the water climbed in each tube.



Questions:

1. Which capillary tube allowed the water to rise to the greatest height?

   ....

2. Try to give a reason for this:

   ....

   ....

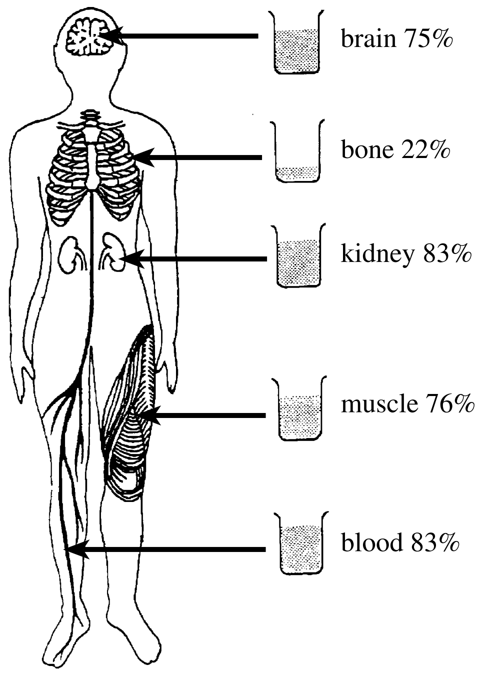
3. Predict what would happen to the water level if you had a tube with a narrower bore.

   ....

   ....

BLM 1.12a: Text extract

Water in our bodies



Water makes up a large portion of our bodies.

Some living things are nearly all water. The simple jellyfish is 99% water. The human body consists of about 65% water. Generally, the slimmer you are, the more water your body contains. Fat people are about 55% water but slim people are up to 70% water.

Each day people need to consume three or four litres of water. But on hot days, and especially when you play sport, your body may need up to fifteen litres of water. This can be in the form of liquid or solid food.

Where does all the water go?

Water leaves our bodies when we breathe or perspire and with excreted waste.

Breathing

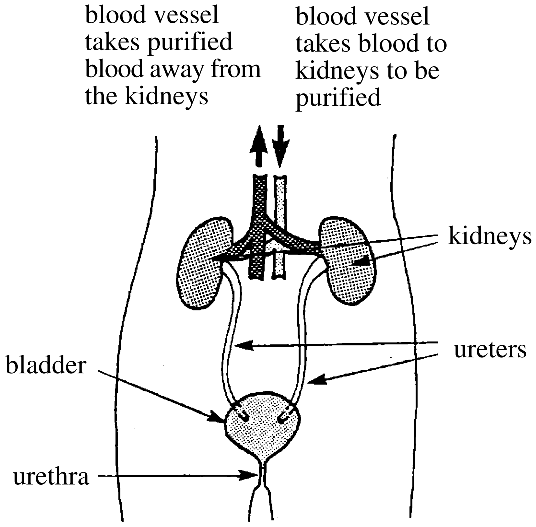
When we breathe, some of the water in our bodies is expelled. The water in our breath helps protect our lungs and throat. Try breathing on a glass of ice, and water droplets will form on the glass.

Perspiration

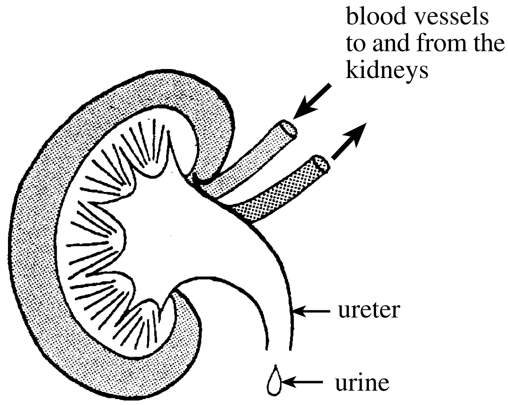
Our bodies need to cool down when we work or get too hot. The body cools off by perspiring or sweating. Water is released from the pores of the skin and forms a wet layer over the skin. As the water evaporates, it takes the heat from the body and cools it. Most of the time we don't notice the process because the heat and wind dry it off as it forms. On hot dry days or when we work or play sport, as much as two litres can be lost as sweat in an hour. For good health it is important to make sure that you drink plenty of liquid on hot days.

Waste from our bodies

A small amount of water is expelled from our bodies in solid wastes. However, most of the water leaves our bodies in liquid wastes as urine.



How waste materials are removed from the blood

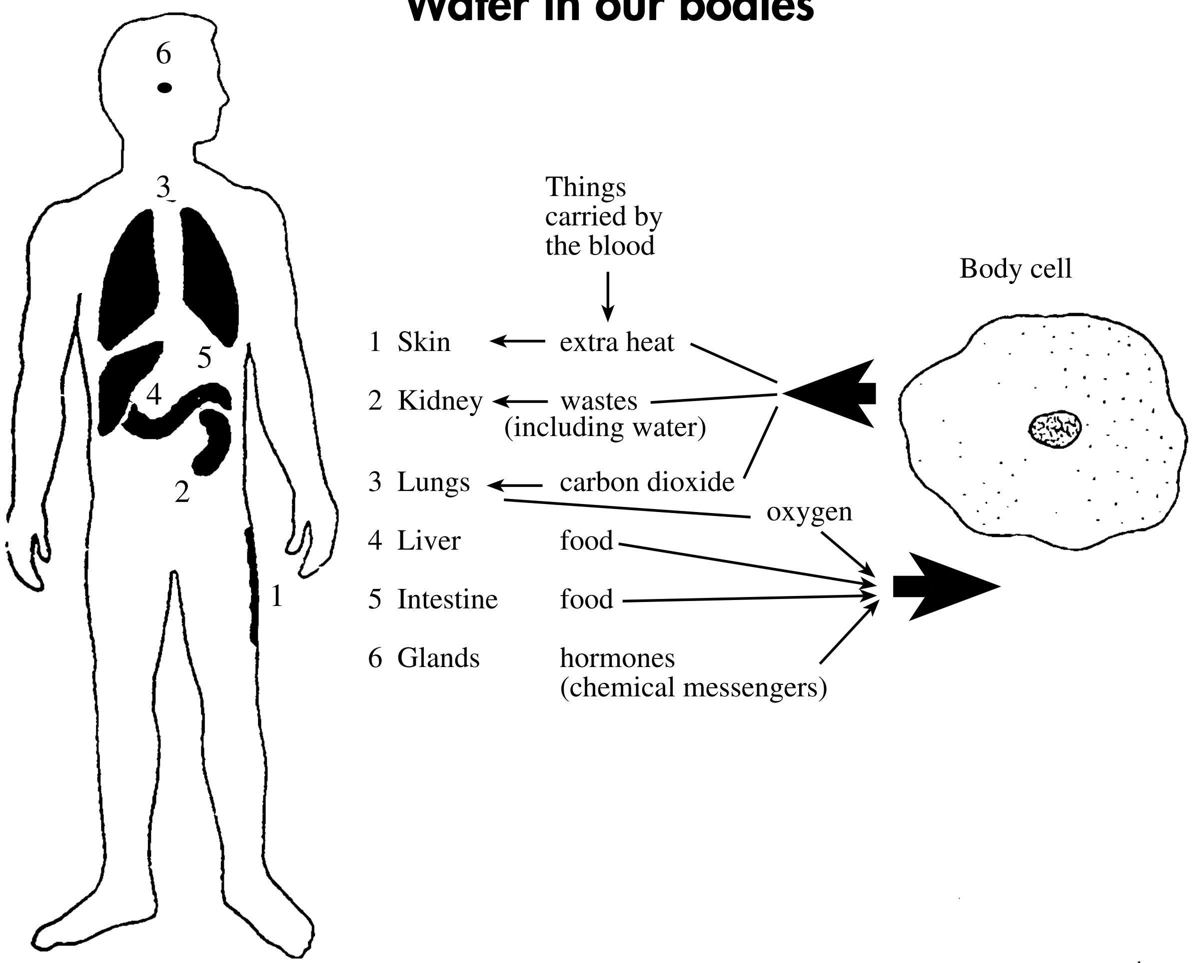


The kidney: a blood-cleaning organ

(Adapted from Perrin, W. *Science, Technology and Society, Book 1*. Jacaranda Press)

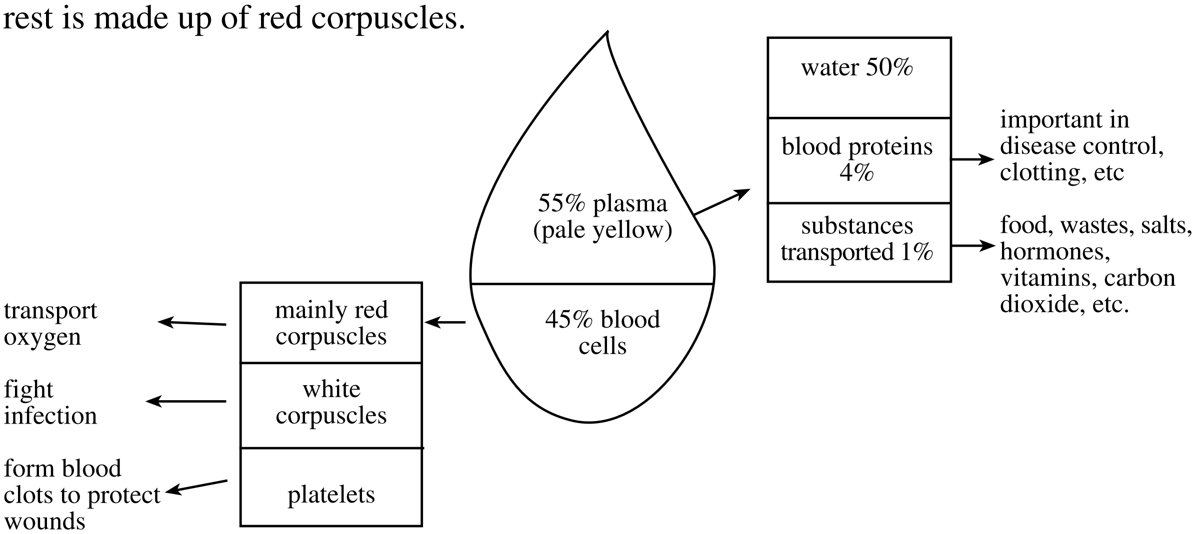
BLM 1.12b: Text extract

Water in our bodies



Food is of no use to the body until it gets into all the millions of body cells. It is carried to them from the intestine by the blood system. Not only does the blood carry the food, but it carries to the cells everything they need and carries away all their wastes. The diagram shows what a large and complex job this is. As well, the blood acts as the defence system for the whole body.

To do all this, the blood is amazingly complicated. About half is water, and most of the rest is made up of red corpuscles.



(From Jenkins, Sweeney, et al, *Science Scene, Book 2*, Edwards Arnold, Australia.)

BLM 1.13: Report scaffold: *Water in the human body*

Title: ....

Classification:

Description: how much water is used in our bodies

Description: how water is used by our bodies

Description: how water is lost from our bodies

Unit two: Properties of water/Procedures

Text type focus: Procedures

Introduction

Rationale

This unit is designed to assist students to produce successful procedures while they investigate some of the important properties of water.

It begins with the modelling and deconstruction of procedures as well as identifying the purpose of writing procedures. It includes recognition of the organisational elements of procedures such as:

- the use of action verbs in the simple present tense;
- the sequencing of steps;
- the use of words or groups of words which tell how, why, when, where, with whom; and
- the appropriate use of technical terms.

Explicitly recognising and identifying structural and language features will assist students to understand and respond appropriately when listening to or reading procedures and will help them to write successful procedures.

Procedures are presented to students as one part of a traditional experimental report in many textbooks. Teachers are encouraged to have students write their own as a legitimate literacy outcome. These procedures are only one of a number of possible experimental records which teachers may ask students to generate (see Chapter 2).

Expected learning outcomes

Students will be able to:

- write successful procedures for experiments they perform (Literacy)
- investigate a variety of simple situations, objects and scenes (Science 7-10)
- predict outcomes, generate hypotheses and explanations directly related to observations they have made (Science 7-10)
- work effectively in groups (Science 7-10).

Vocabulary

procedure, noun, verb, observation, decomposition, soluble, solution, solvent, solute, hydrate, dehydrate, rehydrate, absorb, absorbent, absorbency, adhesion, cohesion, meniscus

Overview

Page 1 of 2

Unit 2: Properties of water/Procedures — **Text type: Procedures**

Phase of the teaching/ learning cycle	Learning activity	Language emphasis	Resources	Learning indicators Students can:	Assessment suggestions
Determining prior learning	Activity 1. Brainstorming students' ideas. • Individual brainstorm for words to describe water	• building vocabulary		• recall words which describe water	• Teacher observation
	Activity 2. Building a concept map. • Group activity	• listening • interpreting	BLM 2.1	• use technical terms correctly • work cooperatively in a group	• Teacher observation
Modelling	Activity 3. Examining parts of a traditional experimental report. • Teacher-led discussion of procedures	• purpose, structure and some features of procedures	BLM 2.2a OHT 2.2b	• identify the structure and some language features of a procedure • state the purpose of procedures	• Written test
	Activity 4. Decomposing water with the voltameter. • Teacher demonstration • Student completion of BLM 2.2a	• structure of experimental reports • use and position of action verbs	BLM 2.2a OHT 2.2b	• identify hydrogen gas and oxygen gas	• Practical report
	Activity 5. Making a flavoured ice block. • Student exercise: Changing word order for a procedure	• sequencing • use and position of verbs	BLM 2.3	• correctly locate verbs when writing procedures	• Assessment of BLM 2.3
	Activity 6. Solubility. Activity 6a. Testing the solubility of iodine. • Teacher demonstration and discussion of terms Activity 6b. Description of a solution. • Student activity: Read and retell • Teacher-led plenary Activity 6c. Reinforcing spelling. • Student spelling drill Activity 6d. Testing the solubility of some common substances in water. • Student sequencing exercise • Student experiment	• building vocabulary • listening • reading and comprehension • spelling • sequencing • some features of procedures	BLM 2.4 BLM 2.5	• use technical terms correctly • work cooperatively with a partner • follow written instructions to complete a task	• Practical report • Quiz • Assessment of BLM 2.5

Unit 2: Properties of water/Procedures — **Text type: Procedures**

Phase of the teaching/ learning cycle	Learning activity	Language emphasis	Resources	Learning indicators Students can:	Assessment suggestions
Joint construction	Activity 7. Experiment: To make a simple reliable water heater. • Teacher guidance in completion of BLM 2.6a and 2.6b. • Student experiment to determine the effect of heat on copper sulfate	• interpreting • writing a procedure	BLM 2.6a BLM 2.6b	• match diagrams, sequence steps and interpret diagrams	• Assessment of BLM 2.6a and BLM 2.6b
	Activity 8. Experiment: Testing for the presense of water in foods. • Teacher-led discussion and development of experimental method • Student experiment	• writing sentences from oral language	BLM 2.7 OHT 2.7	• use scientific language in preference to everyday language in scientific writing • test simple predictions by experimentation • accept specific roles in groups	• Assessment of experimental record
	Activity 9. Using a beam balance. • "Dictation" strategy	• writing a procedure	BLM 2.8	• follow written instructions to conduct a procedure • use a mass balance • perform simple calculations	• Teacher observation
	Activity 10. Rehydrating some dehydrated food. • Student activity to write a scientific procedure from instructions on a packet of dried peas • Student experiment to determine water content of peas	• reading and comprehension	BLM 2.9	• transform everyday language into scientific language	• Completed procedure and calculation
Independent construction	Activity 11. Adhesion and cohesion. • Teacher demonstration and discussion of capillarity	• use of technical terms		• distinguish between adhesion and cohesion	• Quiz or written test
	Activity 12. Investigation of paper towels. • Teacher-led discussion of experimental design • Student design of experimental method • Student experiment: The absorption of paper towelling • Peer trialing of experiment	• writing a procedure • using a scaffold	BLM 2.10	• design an investigation • recognise a fair test • write and conduct a successful procedure	• Teacher observation • Peer trialing and feedback • Assessment of experimental report

Map linking learning indicators to outcomes

This map can be used to assist you in determining the extent to which students have achieved outcomes in the Science 7-10 syllabus and in literacy.

Unit 2: Properties of water/Procedures	Text type: Procedures
Learning outcomes Students will be able to:	**Learning indicators** Students can:
write successful procedures for experiments they perform (Literacy) *and* predict outcomes, generate hypotheses and explanations directly related to observations they have made (Science 7-10)	• recall words which describe water • use technical terms correctly • identify the structure and some language features of a procedure • state the purpose of procedures • correctly locate verbs when writing procedures • use technical terms correctly • follow written instructions to complete a task • match diagrams, sequence steps and interpret diagrams • use scientific language in preference to everyday language in scientific writing • follow written instructions to conduct a procedure • transform everyday language into scientific language • write and conduct a successful procedure
investigate a variety of simple situations, objects and scenes (Science 7-10)	• identify hydrogen gas and oxygen gas • use a mass balance • test simple predictions by experimentation • distinguish between adhesion and cohesion • perform simple calculations • design an investigation • recognise a fair test
work effectively in groups (Science 7-10)	• work cooperatively in a group • accept specific roles in groups • work cooperatively with a partner

Teaching notes

Phase 1: Determining prior learning

During this phase, students share prior knowledge. Students clarify ideas by building a concept map and seeking definitions of any new terms. Observe students' understanding and use the information to plan future learning activities.

Activity 1

Brainstorming students' ideas

Purpose: This activity assists students to build field vocabulary which will be used in the next activity.

- Students brainstorm to produce a list of words that can be used to describe water.
- Compile the list of words on the board.

Activity 2

Building a concept map of students' ideas

Purpose: The concept map produced will:
- *show what students already know about the topic*
- *allow new words to be explained*
- *build field knowledge*
- *support students in building meaningful sentences.*

- Organise students into groups of four or five.
- Give each group a copy of the words from BLM 2.1. (Notice nouns in boxes and linking words in arrows. The boxes and arrows will need to be cut from a copy of the master the first time you use this activity.)

  The group then adds any extra words identified during the brainstorm.

  The group uses the words to create a concept map in the following way:

  (i) A student hands out the words and arrows to the others

  (ii) A student places a box (e.g. ICE) on the desk and explains what the word means. The next student places a box (WATER) and an arrow (e.g. MELTS) in between to link this box to the first box. Other members of the group may help to make the connections. Students place only one noun at a time.

  (iii) Students then take turns placing a box and an arrow on the desk, explaining the meaning each time as they do.

  (iv) The group can agree to change the positions of the boxes and arrows. When finished, these could be attached to a base sheet for display and sharing with the class.

Group work: How can it be used effectively?

Student talk in small groups provides opportunities for them to connect past and present experiences and make sense of new information.

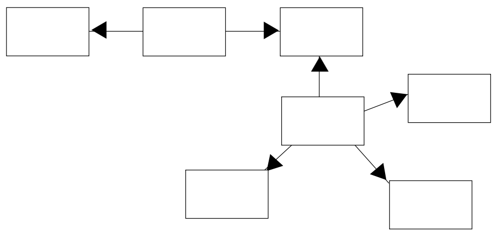
This is less threatening than having to commit themselves in front of the whole class or in writing.

Talk in groups has the potential to engage more students than whole-class discussion. Talk about the topic in groups will also allow students to learn from each other. Talk about ideas is a precursor to effective writing about the ideas.

To make group work effective

Ensure students are clearly aware of the tasks and expected outcomes. Setting time guidelines will provide a little positive stress to assist the group stay on task.

Strategy: Concept maps



Concept maps show the links between ideas. Ideas (nouns or noun groups) are written inside the boxes and are linked with verbs to show the connections.

Concept maps are individual; there is no right answer. Their construction should be demonstrated for students. They are a useful assessment tool to check students' understanding either before commencing the unit or at the end. They should be added to and changed as needed.

Phase 2: Modelling

The purpose of this phase is to assist students to recognise the structures and features of the procedure text type by analysing, or deconstructing, model procedures. At the same time students will build field knowledge about the composition of water and solubility.

Activity 3

Examining parts of a traditional experimental report

Purpose: to show students how a procedure is structured and the grammatical features it uses so they can recognise them in an example.

- Point out that experimental reports are a particular type of writing used in school science to model typical scientific writing by professional scientists.

Experimental reports commonly have the following parts (those parts in bold are the most common parts of a traditional experimental report found in junior science):

- **AIM**
- EQUIPMENT
- **METHOD**
- DIAGRAM
- **RESULTS**
- ANALYSIS OF RESULTS
- **CONCLUSION**

This is written in the form of a procedure or a procedural recount

Text type: Procedure

Purpose:
To instruct someone on how to do something.

Structure:
1. *Goal*
2. *Steps*

Language features:
- *verbs usually at the beginning of each instruction*
- *words or groups of words which tell us how, why, when, where, with whom.*

(Ref. NPDP, Module 2, page 14)

- Guide the class through a deconstruction of that part of BLM 2.2a which are procedures. Use OHT 2.2b which is an annotated copy of BLM 2.2a.

Point out that the method in BLM 2.2a contains two procedures, each with a goal and steps. Sometimes the goal of the procedure is not given with the method as it may be implied in the heading or *Aim* of the experiment. Often procedures in science include a list of equipment and/or materials. Point out that procedures in other contexts (e.g. recipe books and instruction manuals) have a *goal, materials* and *steps*. Emphasise that a scientific procedure typically includes a labelled diagram.

- Put these questions to the class:
  - What is the purpose of a procedure? (i.e. Why was it written?)
  - Who writes the procedure?
  - Who reads procedures?
  - Why are procedures important in science?
- Students identify the parts of the procedure text type within the experimental report.
- Continue discussing the parts of the procedure text type within the experimental report.

A procedural text can be written as a **Procedure** or a **Procedural Recount**. Encourage students to write procedures because this will assist them to follow procedures presented in text books or by the teacher in class. The ability to write effective procedures is a useful life skill for students.

- Discuss the purpose or function of the parts of a traditional experimental report in more detail as students progress through the rest of this activity and activity 4.

- Students identify the parts and the purpose of each part of the experimental report.

The **Aim** is the overall goal of the activity. It states precisely what the experimenter is trying to find out. It can be written as a hypothesis.

The **Equipment** is a list of all the materials needed to perform the experiment.

The **Method** is a set of steps instructing the reader how to do the experiment. Its goal is usually to do with making observations, or collecting measurements, making something or making something work. It can be simple or very elaborate.

The **Diagram** shows visually how equipment is set up or draws attention to important elements of the situation.

The **Result** is a record of observations and recounts what happened. It is most often written in the past tense or in the form of a table. Results may also include measurements, diagrams, photos, maps, etc. Results are not right or wrong – they are simply observations made. They need to be interpreted in order to arrive at a conclusion.

Analysis of results is an attempt to make sense of what has been observed or measured. This part can contain a discussion, graphs, diagrams, flow charts, etc.

The **Conclusion** is a statement of what has been learned from the experiment and is most often written in the present tense. It relates back to the "Aim" of the experiment. Sometimes the conclusion may be that the experiment did not achieve the "Aim".

- Remind students that procedures have action verbs. Action verbs describe the action or event. They tell you what somebody or something is actually doing.
- Students identify and circle each of the action verbs on BLM 2.2a.
- Pose the question: *Where do these action verbs occur in each sentence?*

Students should recognise that in procedures action words occur at the beginning of the sentence and are written in the present tense.

- Ask students: *What is the purpose of having numbers at the beginning of the "Method" steps?*

Order words (i.e. numbers) and action verbs are important, because the order is crucial and a method is about action. (Contrast this with other types of sentences, e.g. statements and questions)

Activity 4

Decomposition of water

Purpose: to demonstrate that water is composed of hydrogen gas and oxygen gas and to model how procedures can be part of a scientific report.

- Demonstrate the decomposition of water using the voltameter (see BLM 2.2a). Point out the volume ratio of the gases produced. Collect and test each gas.
- Discuss the features and purposes of the *Result* and *Conclusion* part of a traditional experimental report.
- Students record results on the experiment report sheet (BLM 2.2a).
- Students complete the *Conclusion.*

Writing effective conclusions

Many students have difficulty in writing conclusions. They often repeat the results or make very general statements, such as "The experiment worked well!". Encourage students to discuss or make an analysis of their results before they write the conclusion. Guide students to look back at the aim of the experiment to help them decide how to word the conclusion.

Activity 5

Making a flavoured ice block

Purpose: to reinforce the use of verbs at the beginning of procedure steps.

- Distribute BLM 2.3 and explain the activity.
- Students practise changing the word order for procedure writing so that the verb is first.
- Students reorder each sentence. Complete the first one as an example. [Answer: *Rinse the jug*.]

An answer for BLM 2.3:

GOAL:
To make flavoured water ice blocks

STEPS:

1. Rinse the jug.
2. Pour 250 mL cordial into the jug.
3. Add water up to the 1 Litre mark.
4. Stir the cordial and water mix.
5. Taste the mixture to check if it is the right strength.
6. Pour the mixture into each part of the mould.
7. Place the iceblock sticks into each part of the mould carefully.
8. Put the mould into the freezer compartment.
9. Freeze it for at least three hours.

Activity 6

Solubility

Purpose: This activity is designed primarily to build field knowledge and to reinforce the use of technical terms through speech, writing and practical activity. The value of the use of technical language is demonstrated.

Activity 6a

Testing the solubility of iodine

- Demonstration of the solubility of iodine in water, methylated spirits and cyclohexane. **Safety caution: Cyclohexane and iodine must not be handled by students.**
- Introduce and define the terms: *soluble, solution, solvent* and *solute* in context while performing the demonstration.

ANSWER: Iodine is partially soluble in water and produces a light brown colour. In methylated spirits, it forms a brown solution and in cyclohexane it produces a violet colour.

Activity 6b

Description of a solution

- Students read a description of *Solutions* (BLM 2.4). Students take turns to retell what they have read to a partner.
- Discuss the activity with the whole class. Summarise the class discussion by emphasising that water is found in living things.

Read and retell

Read and retell is an activity where students are asked to read an activity a number of times and then retell it either orally or in writing. It involves brainstorming key words to help introduce new vocabulary and spelling. The brainstormed words and phrases also act as a memory prompt for the retelling task. The example used in this unit of work involves oral retelling.

Activity 6c

Reinforcing spelling

- Students add new technical words to the topic vocabulary list.
- Students learn their spelling using the strategy: LOOK–SAY–COVER–WRITE–CHECK.

Strategy: Spelling

LOOK–SAY–COVER–WRITE–CHECK
This strategy enables students to use the visual, auditory and kinaesthetic memory systems to recognise and recall accurate spelling.

Activity 6d

Testing the solubility of some common substances in water

- Students correctly sequence the steps of the method on BLM 2.5 for testing the solubility of chalk powder, copper carbonate, copper sulfate, salt, sugar, and sulfur in water.
- Students perform the experiment.

Phase 3: Joint construction

Students will be supported in writing effective procedures in this phase. Students will further develop experimental skills and techniques, and increase their understanding of concepts, as they investigate the water content of foods.

Activity 7

Experiment: To make a simple, reliable water detector

Purpose: to build field knowledge for subsequent investigations. The cloze component assists students to select appropriate verbs.

- Reinforce the structure and language of procedures and the experimental report as students complete BLM 2.6a and 2.6b.
- Students complete the method by using verbs from the list provided.
- Students match the diagrams with the correct step.
- Students carry out the experiment and complete BLM 2.6a and 2.6b.
- Students consider how dehydrated copper sulfate could be used to detect water.

Activity 8

Experiment: Testing for the presence of water in foods

Purpose: to support students in writing procedures using scientific terms.

- Discuss with the whole class a procedure to test for the presence of water in vegetables.

> Talk about the types of food that could be tested. Discuss whether whole foods or juice should be used. Ask students to bring in foods for testing. Suggested foods include: "pure" orange juice, skin and segments of an orange, cooking oil, dried foods, fresh foods such as onions and potatoes.

- Summarise the class discussion in common language on the board as a flow chart of the steps. Convert into scientific language as a class, i.e. use correct language for equipment and processes.
- Students write their own procedure on the scaffold provided on BLM 2.7.
- Display an OHT of BLM 2.7. Determine class consensus for students' predictions of the foods which will contain water. Record the class predictions using a table on the board (headings: "Water" and "No water").
- Assign the following roles to the students in a group of three to conduct the experiment:
  1. Chief scientist: performs the experiment and is the group representative
  2. Recorder/ materials officer: collects foods and records results
  3. Safety officer/equipment officer: collects equipment for the experiment and is responsible for monitoring safety, for example, lighting of Bunsen burner, cooling down hot equipment before it is put away.

- Students conduct experiment and complete the observation table on BLM 2.7. Explain any differences between observation and prediction.
- Class reports back on the results

Strategy: Predict–Observe–Explain (POE)

This is a strategy that can be used to find out what students know. It is a safe way for students to solve problems and a fun way to begin an activity.

Predict

Students are given a situation and asked to predict what will happen when some action occurs or some change is made.

Observe

After the students have made their predictions, a change to the situation is made and the students are asked to observe carefully the results of the change.

Explain

Students are asked to then sort out and to explain the differences between what they expected to happen and what did happen.

Principles of using the POE strategy

- *These activities are not meant to be a trick.*
- *Activities should be based on what students may already know.*
- *Allow time for students to think about the question.*
- *Ask students to give a reason for their prediction.*
- *Accept all predictions without judgement.*
- *Students can change their minds as they share their ideas.*
- *Students should record their observations.*
- *Students should attempt to explain their predictions.*
- *When there is conflict with the prediction, the student should try to modify the prediction to fit the observation.*
- *Encourage questions that may lead to follow-up activities.*

Activity 9

Using the beam balance

Purpose: This activity encourages students to make systematic observations of a procedure.

- Prepare students for a **Dictadem**.

Procedure for the dictadem:

1. Put the heading "How to use a beam balance to find mass" on the board.
2. Students copy heading (suggest they use rough paper).
3. Demonstrate the use of the beam balance while reading the text on BLM 2.8 aloud.
4. Instruct students to write down the key words and phrases. (Students take notes to reconstruct the instructions.)
5. Repeat the demonstration so that students can write additional key words and phrases.
6. Students return to their groups and write a procedure for using the beam balance.

- Students complete the dictadem while observing a demonstration of how to use a balance.
- Give or display BLM 2.8 so students can evaluate their written instructions by comparing them with the original text.

Strategy: Dictadem

*This is a practical science version of the "*Dictagloss" strategy. Instead of just reading a text aloud, the teacher carries out demonstrations and the students construct a procedure after watching the demonstration.*

***Dictagloss**

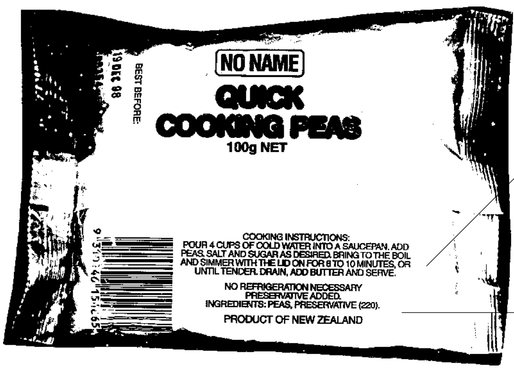
A dictagloss is a useful activity for assisting students to use language for learning. It also develops listening and note taking skills. A passage is read aloud at normal pace while students write down key words and phrases. The passage is re-read and students add other important details. Students then work in groups or individually to reconstruct the text.

Activity 10

Rehydrating some dehydrated food

Purpose: to give students practice in writing successful scientific procedures from everyday language.

- Provide student groups with a packet of dehydrated peas (or a copy of the instructions from one.)
- Students change the conversational language of the instructions on the pack of peas to the language of procedure (as used in a science laboratory). Students read BLM 2.9, which explains what else will need to be done to determine the water content of the peas.



Cooking instructions:
Pour 4 cups of cold water into a saucepan, add peas, salt and sugar as desired. Bring to the boil and simmer with the lid on for 8 to 10 minutes, or until tender. Drain, add butter and serve.

No refrigeration necessary
Preservative added.
Ingredients: peas, preservative (220).

Possible answer:

1. Add 150 mL water to a 250 mL beaker.
2. Place the beaker on a gauze, on a tripod set up over a Bunsen burner.
3. Accurately weigh about 10 g peas and record this mass (M1).
4. Add peas to the water in the beaker.
5. Boil the water in the beaker.
6. Allow the water to boil very gently for 10 minutes.
7. Allow to cool.
8. Drain water and accurately reweigh peas. Record the mass (M2).
9. Determine amount of water absorbed by subtracting M1 from M2.

- Students record the full procedure for the experiment on BLM 2.9.
- Students carry out the experiment and complete BLM 2.9 as their experimental record.

  Caution: Remind students of safety precautions when heating and that peas SHOULD NOT be eaten when cooked in laboratory equipment.

Adjust the complexity of the table according to the level of your class. You may need to model the calculation on the board.

Optional enrichment activities

- Make a list of the names of some dried foods
- Use a range of dehydrated foods e.g. beans, corn, potato, carrots
- Draw a column graph to show the % water content of the foods tested by the class
- Set up a database for a column graph and produce the graph on the word processor
- Set up a database to perform the calculations in the experiment.

Phase 4: Independent construction

Students will test and demonstrate their ability to write an effective procedure in a new but related context. This new context provides a further opportunity to build field knowledge.

The main goal for the independent construction phase is to withdraw the support of the teacher.

Activity 11

Adhesion and cohesion

Purpose: to build field knowledge and challenge thinking about properties of materials.

- Demonstrate capillarity by showing the height that coloured water moves in three tubes with different diameter bores. Discuss the idea that water sticks to the glass. Introduce the term adhesion. Relate the shape of the meniscus in the measuring cylinder to the adhesion of water molecules.
- Remind students that we use paper towels to absorb spills and that water adheres to the paper towel.

Activity 12

Investigation of paper towels

Purpose: to provide an opportunity for students to write a successful procedure. In this activity students will compare two brands for a particular physical feature. They will then develop a procedure for the comparison, which they will provide to another group. This group will then attempt to gain the same results and thus arrive at the same conclusions as the initial group. This activity will therefore provide an opportunity for the class to model the process of validating scientific works. It will also act as a very useful check on the success of students' written procedures.

- Discuss the design of an experiment to test some feature of paper towels for two brands. Possible bases of comparison: brands, thickness, shape, size of air spaces and the effect on the amount of water that can be absorbed.
- Students discuss in groups to develop an experimental design.
- Discuss whether the proposed experiment is a "fair" test.
- Students (in groups) write a procedure, perform the experiment and record the results in their note books.
- Students then use BLM 2.10 as a scaffold to produce an experiment for other groups to attempt.
- Allocate the students' designs for experiments to other groups for testing.
- Students carry out the procedure and compare their results with the results of the designing group.
- Lead a class discussion of the outcomes after trial experimentation.

*Students recording their results will frequently write a **Procedural Recount**. It would be useful to point out to students that to change this to a **Procedure** they would need to:*

- *change the tense from past to present*
- *split up sentences that have more than one action*
- *reorganise sentences to begin with a verb*
- *number each step and eliminate words like "firstly", "then" and "next".*

Depending on the developmental stage of the students, BLM 2.10 could be written:
- independently
- in groups for some components, with individuals writing their own experimental reports
- totally as a group assignment.

BLM 2.1: Concept map components

BOXES = nouns or words to form noun groups; ARROWS = linking words

POLAR ICE CAP	LIVING THINGS	FARMERS
SEA WATER	HARD WATER	SEA WATER
ICE	GLACIERS	FORMS
SNOW	TASTELESS	FORMS
RAIN	ODOURLESS	IS USED BY
STEAM	PLANTS	IS USED FOR
WATER	SOLUTIONS	IS USED FOR
LAKES	ANIMALS	MAKES UP
LIQUID	HOUSEHOLDS	MELTS
COLOURLESS	COOLING	CONDENSES
FROZEN	COOKING	BOILS
RIVERS	EVAPORATION	FREEZES
OCEAN	CLEANING	COOLS
CREEK	WASHING	IS
FACTORIES		EVAPORATES

BLM 2.2a: Experiment scaffold

Decomposition of water

Procedure 1:

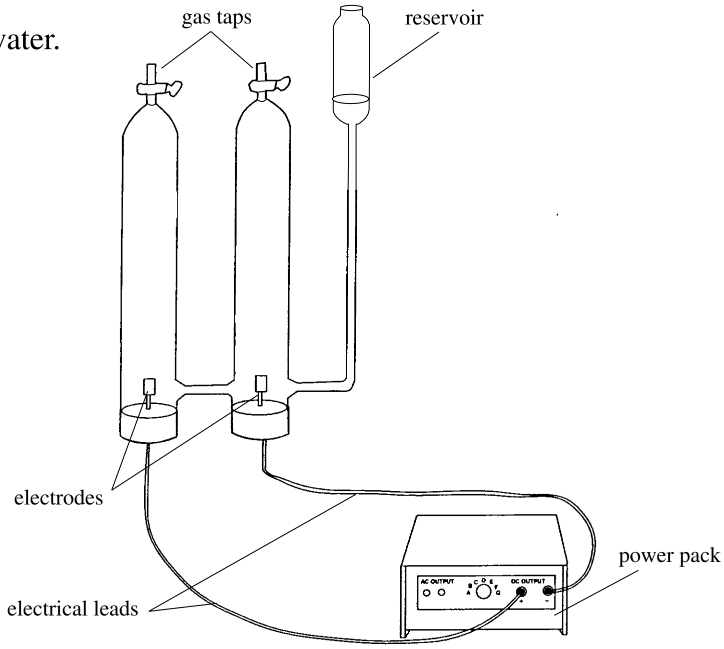
Aim:

To find which substances make up water.

Equipment:

- voltameter
- 2 x stoppered test tubes
- wooden splint
- electrical leads
- power pack
- dilute acid

Diagram:



Method:

Part A: Decomposing the water

1. Set up the equipment as shown in the diagram.
2. Turn on the electrical current for several minutes.
3. Record your observations.

Part B: Testing the gases

1. Collect each gas in a separate test tube and seal the test tubes with a stopper.
2. Test for hydrogen by holding a burning wooden splint near the top of each tube and then removing the stopper. Hydrogen will produce a "pop".
3. Collect more gas in each test tube.
4. Test for oxygen by holding a glowing wooden splint near the top of each tube and then removing the stopper. Oxygen will relight the splint.
5. Record your observations.

Results:

Part A:

Part B:

Conclusion:

When water is decomposed, it produces two gases: .... and ....

BLM 2.2b: Annotated copy of 2.2a

Decomposition of water

Procedure 1:

Aim:

To find which substances make up water.

Equipment:

voltameter
2 x stoppered test tubes
wooden splint
electrical leads
power pack
dilute acid

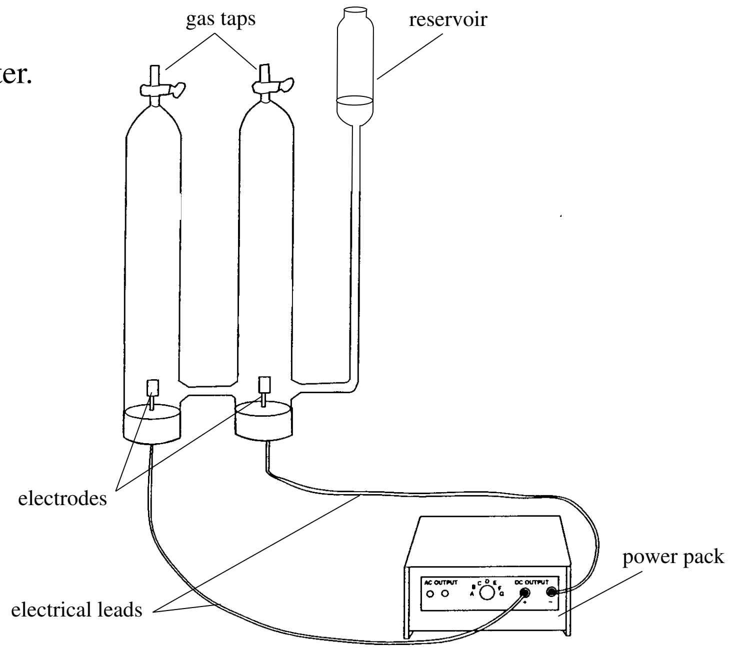
Method:

Part A: Decomposing the water — Goal

1. Set up the equipment as shown in the diagram.
2. Turn on the electrical current for several minutes.
3. Record your observations.

— Steps

Diagram:



Part B: Testing the gases — Goal

1. Collect each gas in a separate test tube and seal the test tubes with a stopper.
2. Test for hydrogen by holding a burning wooden splint near the top of each tube and then removing the stopper. Hydrogen will produce a "pop".
3. Collect more gas in each test tube.
4. Test for oxygen by holding a glowing wooden splint near the top of each tube and then removing the stopper. Oxygen will relight the splint.
5. Record your observations.

— Steps

Results:

Part A:

Part B:

Conclusion:

When water is decomposed, it produces two gases: ……………… and …………………

BLM 2.3: Worksheet

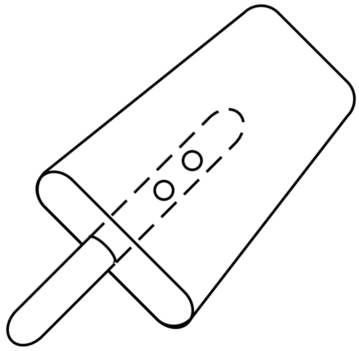
Making flavoured water ice blocks

Underline the verbs (words that tell you the action being done).

Change the word order of the following sentences so that the verbs are at the beginning of each step. You may need to change some of the words.

Goal:

To make flavoured water ice blocks



Steps:

1. The jug is rinsed.

   ....

2. 250 mL of the cordial is poured into the jug.

   ....

3. Water is added up to the 1 litre mark.

   ....

4. The cordial and water mix is stirred.

   ....

5. To check if it is the right strength the mixture is tasted.

   ....

6. The mixture is poured into each part of the mould.

   ....

7. The iceblock sticks are placed carefully into each part of the mould.

   ....

8. The mould is put into the freezer part of the refrigerator.

   ....

9. For at least three hours freeze it.

   ....

Solutions

A *solution* is a mixture. It is obtained by dissolving one substance in another, for example by stirring sugar into water.

A solution contains a solute and a solvent. The liquid which is used to make the solution is called the *solvent*. The solid which dissolves is called the *solute*.

Water is the solvent which is most often used to make solutions. It makes up about 65% of blood and is important because it carries dissolved substances, such as gases, simple foods, vitamins and minerals, around the body to places where they are needed. It is used as a solvent for some paints which are said to be *water soluble*.

Other liquids also are used as solvents. Methylated spirits is a good solvent for some inks. Dry cleaning fluid works well to dissolve stains which contain fat. Mineral turpentine is suitable for dissolving paints which are not water soluble.

BLM 2.5: Worksheet

Testing the solubility of common substances

1. The experimental report below has a number of parts. Using the space provided at the side, write in the purpose of each part.
2. In the experimental report below the method steps are missing. Complete each of the steps in the method, in order, by choosing from the following list:
   - Fit the stopper in the test tube and shake the test tube.
   - Repeat steps 2-4 for the other five solids that are available.
   - Add a quarter spoonful of copper sulfate to one test tube.
   - Measure approximately 10 mL of water into each test tube.
   - Observe what happens and record your observations in the results table below.
3. For each step in the procedure, underline the verb.

(Cut here and paste into your book)

Purpose of parts

Testing solubility

Aim:

To find out which substances dissolve in water.

Equipment:

test tube rack	6 test tubes	rubber stopper	6 plastic spoons
sugar	salt	chalk powder	sulfur
copper sulfate	copper carbonate		

Method: Testing for solubility

1.
2.
3.
4.
5.

Results:

Solid tested	Observation	Solubility (high, low or not)
chalk powder copper carbonate copper sulfate salt sugar sulfur		

Conclusion:

BLM 2.6a: Experiment scaffold

Detecting water

Aim: To make a simple, reliable water detector

Equipment:

copper sulfate	heat mat	test tube holder	dropper
Bunsen burner	matches	test tube	water

heat	add	hold	observe	put	record	observe	place	record

Method: Making dehydrated copper sulfate

1. ____________ half a spoonful of copper sulfate into a test tube.

2. ____________ and record the colour of the copper sulfate.

3. ____________ the test tube with the test tube holder.

4. ___________ the test tube gently over a blue Bunsen flame.

5. Observe carefully and ___________ your observations in the table below.

6. ____________ the test tube in a test tube rack and allow it to cool.

7. ____________ three drops of water to the powder in the test tube.

8. ____________ and ____________ your observations in the results table below.

BLM 2.6b: Experiment scaffold

Detecting water (continued)

Results:

Step	Observation
Observing the copper sulfate before you begin	
Heating copper sulfate in a test tube	
Adding water to copper sulfate	

Conclusion:

What substance is on the sides of the test tube when the copper sulfate is heated?

....

What other changes can you observe when copper sulfate is heated?

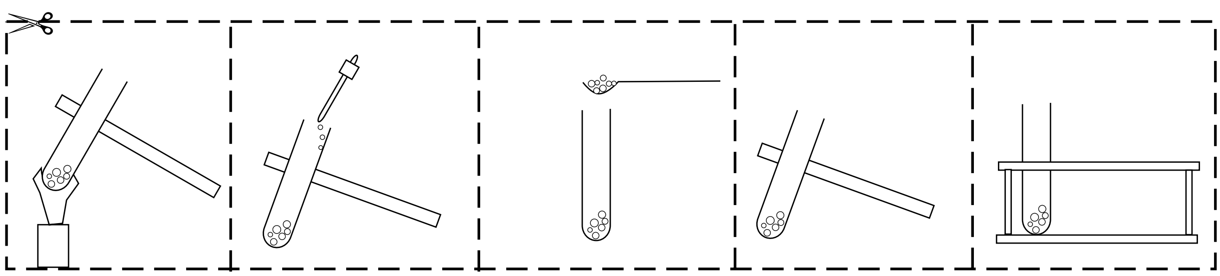
....

How can copper sulfate be used to detect water? ....

....

....

Cut out and paste these diagrams in correct order in the method section on BLM 2.6a.



Water content in foods

Procedure

Goal:

Steps:

Water content in foods

Prediction:

Water	No water

Reasons for prediction:

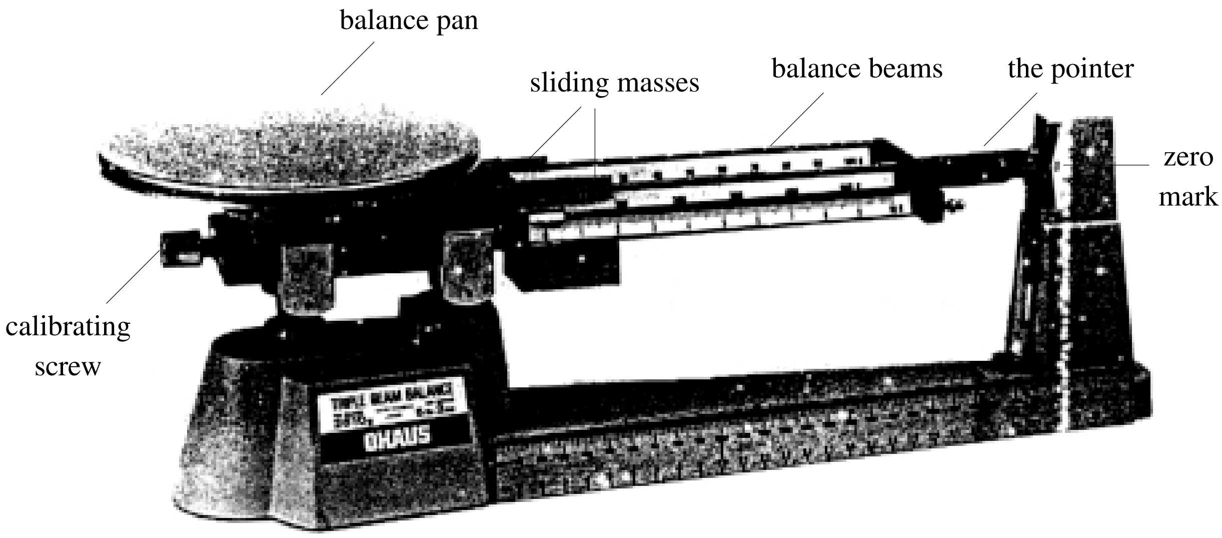
Observation:

Water	No water

Explanation:

BLM 2.8: Dictadem

Using a beam balance to measure mass



Procedure for weighing:

1. Identify the balance pan, balance beams, the pointer, the sliding masses, the calibrating screw and the zero mark.
2. Move all the sliding masses into the zero position. If the pointer on the balance arm does not line up with the zero mark, the balance needs adjusting by turning the calibrating screw.
3. Put the object to be weighed on the balance pan.
4. Slide the biggest mass along its arm, to the right, one notch at a time until the arm swings down. Slide the mass back one notch.
5. Repeat step 4 with the next sized mass.
6. Finally, slide the smallest mass along its arm until the pointer is in the zero position.
7. Read the mass of the object by adding all the figures shown on each arm.
8. Write down the mass of the object. Be sure to write down the unit being measured.

BLM 2.9: Background and scaffold

Water content of peas

Dehydration is a common way of preserving food (making it last longer). Dehydration is the removal of water. Food is dehydrated by leaving it in the sun or by using drying ovens.

Bushwalkers often take dehydrated food on long walks, because it is lighter than whole food. Food is easily rehydrated by adding water to it.

In this experiment we will calculate how much water is contained in peas by measuring the dry weight, rehydrating them and then reweighing the rehydrated peas.

Experimental record

Write your procedure in the following space:

The water content of hydrated peas

Calculations:

Trial	1	2	3	*** total	**** average
Mass of dried peas					
Mass of rehydrated peas					
* Mass of water added					
** % Water content					

Measurements:

* Mass of water added = Mass of rehydrated peas - Mass of dried peas

** % water content = $\frac{\text{Mass of water added} \times 100}{\text{Mass of rehydrated peas}}$

*** Total = measurement 1 + measurement 2 + measurement 3

**** Average = $\frac{\text{total}}{3}$

My answer for the average water content is …………………%

The class average was …………………%

How absorbent are paper towels?

This scaffold will be completed in two stages. Firstly, the design group will write an *Aim* for the experiment. In the boxed section they will write a procedure for testing the absorbency of paper towels. Later the validation group will carry out the procedure and complete the *Results* and *Conclusion* sections.

Design group:	Validation group: ....

Aim:

Equipment:

Method:

Results:

Conclusion:

Unit three: Explaining the water cycle

Text type focus: Explanation

Introduction

Rationale

This unit focuses on writing explanations. It begins with the modelling and deconstruction of explanations as well as identifying the purpose of writing them.

This unit highlights:

- the recognition of organisational elements of explanations;
- the use of linking verbs in the phenomenon identification;
- the use of action verbs in the simple present tense in the explanation sequence;
- the use of connectives of time and cause-and-effect; and
- the appropriate use of technical terms.

Explicitly recognising and identifying structures and language features will assist students to understand and respond appropriately when listening to or reading explanations and will help them to write successful explanations.

This approach will support learning about the three states of water, the water cycle and water purification. A simple investigation of the particle model of matter is used to assist students to explain phase changes. The particle theory will be developed using generalised particles (rather than a discussion of atoms, molecules, etc.) and relative particle movement due to heat.

The aims of the unit are:

- to investigate water's three states and explain the water cycle
- to assist students to gain control of the explanation text type.

Learning outcomes

Students will be able to:

- write successful explanations (Literacy)
- recall relevant concepts, ideas, theories and laws explaining scientific aspects of situations and problems (Science 7-10)
- predict outcomes, generate hypotheses and explanations directly related to observations they have made (Science 7-10)
- speak clearly and confidently with each other (Science 7-10)
- work effectively in groups. (Science 7-10)

Vocabulary

explanation, noun, verb, technical, phenomenon, sequence, observation, states, volume, compress, compressibility, temperature, freezing, melting, evaporate, evaporating, evaporation, boiling, condense, condensing, condensation, coalescence, precipitation, particle, property, purifying

Overview

Unit 3: Explaining the water cycle — **Text type: Explanation**

Phase of the teaching/ learning cycle	Learning activity	Language emphasis	Resources	Learning indicators Students can:	Assessment suggestions
Determining prior learning	Activity 1. Water, water everywhere… • Student observation of stimulus material • Group brainstorm for information about water and its states and to build knowledge of associated technical terms • Teacher-led classification of terms as technical or non-technical	• building vocabulary • use of technical terms	Photos, posters, slides, OHTs, etc.	• recall that water exists in three states (solid ice, liquid water and gaseous vapour or steam), can change from one state to another and that these changes of state are dependent on energy	• Observation of student lists
	Activity 2. Explaining changes of state. • Teacher-led discussion of the three states of water • Student experiment to determine temperature changes as ice is converted to steam	• use of technical language • oral explanations		• speak clearly and confidently with other students in their group • contribute to group task • draw a graph of the temperature changes as ice is converted to steam	• Teacher observation • Construction of a graph
Modelling	Activity 3. Explaining the three states of matter. • Student participation in a barrier exercise • Teacher-led discussion of the structure and some language features of explanation text	• structure of an explanation • language features of an explanation use of: – present tense – action verbs – connectives – words linking cause and effect – time links	BLM 3.1a BLM 3.1b OHT 3.1 OHT 3.2a OHT 3.2b	• analyse a model explanation by describing its structure, some of its language features and its purpose	• Teacher observation
	Activity 4. Demonstrating features of solids, liquids and gases • Student experiments demonstrating some properties of water, including shape, volume and compressibility of its phases • Class discussion of the usefulness of a particle theory in explaining phase changes • Teacher demonstration and modelling of volume relationships when alcohol and water are mixed	• use of technical terms		• describe some properties of water including shape, volume and compressibility of its phases • use a simple particle model to explain properties of water	• Written test

Unit 3: Explaining the water cycle — **Text type: Explanations**

Phase of the teaching/ learning cycle	Learning activity	Language emphasis	Resources	Learning indicators Students can:	Assessment suggestions
Modelling (continued)	Activity 5. Modelling the three states. • Student construction of a static model of particle arrangements in the three states		BLM 3.2	• construct and describe a model to represent solids, liquids and gases • work effectively with a partner to complete a task	• Written test • Construction of model
	Activity 6. Demonstrating dynamic particle models • Teacher demonstration and explanation of how particles behave as water changes state • Student worksheet: matching exercise	• use of technical terms • constructing sentences	BLM 3.3a BLM 3.3b OHT 3.3c	• use models to explain the relationship between energy and particle movement and the phase • identify cause-and-effect relationships in successful explanations of the properties of states of matter	• Assessment of worksheet
Joint construction	Activity 7. Making models of the water cycle • Student construction and observation of a model water cycle • Teacher-led discussion of how water particles behave			• make and record observations of a model water cycle • discuss the uses and limitations of models in science	• Teacher observation
	Activity 8. Using the particle theory to explain the water cycle. • Teacher-guided completion of worksheet series to examine the range of ways to explain phenomena scientifically • Student sequencing exercise to produce a successful explanation	• structure and purpose of text • use of technical terms • density of scientific language	BLM 3.4a OHT 3.4a BLM 3.4b OHT 3.4b BLM 3.4c OHT 3.4c BLM 3.4d OHT 3.4e OHT 3.4f BLM 3.4g OHT 3.4h	• transform everyday language into scientific language • state the purpose and value of technical terms • use technical terms and scientific concepts appropriately in explaining the water cycle • recognise the structure and language features of an explanation and apply these in sequencing explanations	• Completion of explanation • Written test

Unit 3: Explaining the water cycle | **Text type: Explanations**

Phase of the teaching/ learning cycle	Learning activity	Language emphasis	Resources	Learning indicators Students can:	Assessment suggestions
Independent construction	Activity 9. Writing an explanation. • Student construction of a water purifying device • Student construction of an explanation of the device	• reading • extracting information • drafting and editing • writing an explanation using a scaffold	BLM 3.5a BLM 3.5b BLM 3.6a BLM 3.6b Assessment criteria	• extract information about water purification from text and diagrams and use it to construct a useful device • accept roles and complete tasks within a group • apply a simple particle theory to explain the changes of state of water in a device • write a scientific explanation of how a water purifying system works	• Teacher observation • Assessment of notes, model construction • Presentation of final text • Self assessment

Map linking learning indicators to outcomes

This map can be used to assist you in determining the extent to which students have achieved outcomes in the Science 7-10 syllabus and in literacy.

Unit 3: Explaining the water cycle	**Text type: Explanations**
Learning outcomes Students will be able to:	**Learning indicators** Students can:
write successful explanations (Literacy)	• analyse a model explanation by describing its structure, some of its language features and it purpose • transform everyday language into scientific language • state the purpose and value of technical terms • recognise the structure and language features of an explanation and apply these in sequencing explanation texts • identify cause-and-effect relationships in successful explanations of the properties of the states of matter • use technical terms and scientific concepts appropriately in explaining the water cycle • write a scientific explanation of how a water purifying device works • use technical language in preference to everyday language
recall relevant concepts, ideas, theories and laws explaining scientific aspects of situations and problems (Science 7-10)	• recall that water exists in three states (solid ice, liquid water and gaseous vapour or steam), can change from one state to another and that these changes are dependent on energy • use a simple particle model to explain properties of water • discuss the uses and limitations of models in science • apply a simple particle theory to explain the changes of state of water in a device
predict outcomes, generate hypotheses and explanations directly related to observations they have made (Science 7-10)	• draw a graph of the temperature changes as ice is converted to steam • describe some properties of water, including shape, volume and compressibility of its phases • construct and describe a model to represent solids, liquids and gases • use models to explain the relationship between energy and particle movement and the phase • make and record observations of a model water cycle
speak clearly and confidently with each other (Science 7-10) *and* work effectively in groups (Science 7-10)	• speak clearly and confidently with other students in their group • contribute to group tasks • work effectively with a partner to complete a task • accept roles and complete tasks within a group

Teaching notes

Phase 1: Determining prior learning

During this phase, students share prior knowledge and clarify ideas by building a concept map and seeking definitions for new terms.

Assess students' understanding and skills in the use of explanations. Observe students' understanding and their use of science and literacy information so you can adapt learning activities to the unit in an appropriate way.

Activity 1

Water, water everywhere .....

Purpose: This activity assists students to build field vocabulary.

- Use photos (from books, magazines, posters, slides, etc.) as stimulus for the collection of thoughts about the forms water takes in the environment.

> Make sure the pictures include images of water in its three states e.g. images of clouds, mist, a steaming kettle, rain, oceans, rivers, snow, glaciers, icebergs, etc. Displaying large posters around the room effectively immerses students in the topic.

- Organise students into groups with one student nominated as reporter.
- Students, working in groups, brainstorm to recall words about water in the environment. Reporters produce a list identified by the group and copy the list onto the board.
- Assist the class to classify the terms as either technical or non-technical. Sometimes it is possible to match technical with non-technical terms.
- Students find meanings of technical words for homework.

Group work

How can it be used effectively?

Student talk in small groups provides opportunities for them to connect past and present experiences and to make sense of new information.

This is less threatening than having to commit themselves in front of the whole class or in writing.

Talk in groups has the potential to engage more students than whole-class discussion. Talking about the topic in groups will also allow students to learn from each other. Talk about ideas is a precursor to effective writing about the ideas.

To make group work effective

Ensure students are clearly aware of the tasks and expected outcomes. Setting time guidelines will provide a little positive stress to assist the group stay on task.

Activity 2

Explaining changes of state

Purpose: to reinforce the concept that water exists in three states and to introduce the concept of phase change.

- Demonstrate, and discuss with the class, water in its three states by displaying a large block of melting ice and a beaker of water boiling (or a kettle boiling).
- With students, develop the language that describes the processes causing phase changes.
- Students write their explanation for how water changes from a solid to a liquid and from a liquid to a gas using the appropriate processes.

This activity will be a further indicator of the prior knowledge and literacy skills of the students.

- Students carry out an experiment to observe phase and temperature changes as ice is heated to boiling. Measurements taken each minute are ample. Students should measure temperature for at least five minutes after boiling is observed. They should tabulate temperature changes.

Good results in this experiment can be achieved by beginning with a thermometer either frozen into ice in a beaker or clamped in the centre of an ice/water slurry in a beaker AND by using a moderate flame to heat.

- Students construct a line graph of the changes in temperature against time.

NB. Here, the emphasis of the activity is on explanation, not procedures. To that end, it is not expected that students will spend a lot of time and effort on recording the procedure. However, they must make careful observations of what is going on in the experiment, particularly noting the phase change and temperature change relationships.

Phase 2: Modelling

The purpose of this phase is to assist students to recognise the structures and features of explanations by deconstructing model explanations. The modelling phase will give students the opportunity to build field knowledge about the relationship between the states of water and particle behaviour.

Activity 3

Explaining the three states of water

Purpose: The explanation text used for this barrier exercise allows you to demonstrate the structure and features of an explanation. The activity emphasises how verbs and connectives are used with the technical terms in an explanation.

- Students complete a barrier exercise using a model explanation. (BLM 3.1a and BLM 3.1b)
- Display OHT 3.1c, which provides the answers to the students' barrier exercise.
- Discuss with the class the structure and some of the language features of explanations as exemplified in the models provided by OHT 3.2a and 3.2b.

NOTE: verbs are circled, technical terms are boxed and connectives are underlined (time connectives are single underlined and cause-and-effect connectives are double underlined).

Notice that, unlike a report or procedure, an explanation is a flowing piece of writing. There are links in the flow, in that information at the end of one sentence is frequently picked up in the beginning of the next sentence. This pattern helps to make the events in sentences link to each other. An explanation has an *identification* which is often the title (or subheading) and it will reflect the action, the process or dynamic nature of the explanation. For example, a report may have the heading "Solid to liquid" but an explanation would have the heading "Changing a solid into a liquid" or "Melting a solid". An explanation always follows a logical sequence.

Strategy: Barrier games

Barrier games are excellent activities for communication and revision. They are based on the idea that the students should be separated by a barrier, e.g. sit back-to-back or have a folder between them. Barrier games may be in the form of diagrams, maps, crosswords or tables; the limit is your imagination.

Pairs of students are given two similar versions of the same activity, e.g. crosswords with down clues only or across clues only. Students must share their answers through oral communication. This activity can be extended by asking students to write clues for their crosswords.

Similarly students are given incomplete diagrams which they complete by describing what they have to each other. Students become familiar with describing and using correct language.

Text type: Explanation

Structure of explanations

When writing explanations it is important to remember that they have a special structure. These are the main parts of an explanation:

1. *The **title** or heading (sometimes part of 2).*
2. *The **phenomenon identification**. This is a general statement telling the reader what is being explained.*
3. *The **explanation sequence**. This is the main part of the explanation. There are usually a number of paragraphs, but the sequence could be contained in one paragraph.*

The language that is used in explanations has special features, e.g.:

1. *Use of technical words.*
2. *Use of cause-and-effect connectives, for example, words such as* because, as a result of, causes.
3. *Use of time connectives, for example, words such as* after, following, then, next, initially.

Activity 4

Demonstrating features of solids, liquids and gases

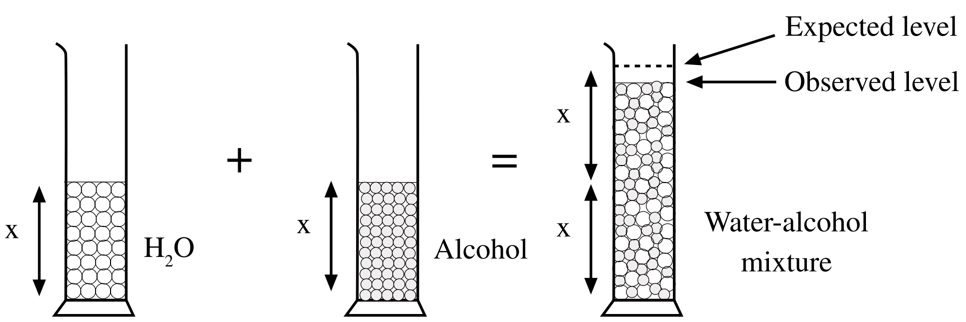
Purpose: This activity builds field knowledge about solids, liquids and gases so that students will be able to apply a simple particle model to explain the properties and phase changes.

- Provide students with a range of simple experiences and experiments so that they can discover the properties of solids, liquids and gases. These do not need to involve only water.

Use experiments from common science textbooks. Examples of helpful experiences include: diffusion (crystals in water); conservation of volume of a liquid in different-shaped containers; compression in a plastic syringe.

- Students perform activities which demonstrate the properties of matter including shape, volume, compressibility.
- Discuss with students how the properties of solids, liquids and gases can be explained using a simple particle model.

The concept can be reinforced by demonstrating the reduced total volume when equal volumes of alcohol and water are mixed and by explaining the phenomena, using peas and rice as an analogy for the alcohol and water particles.



Activity 5

Modelling the three states

Purpose: to provide a concrete representation of the abstract particle model. This will assist students to reinforce their understanding of the particle model.

- Students work in pairs to construct a cut-and-paste model of particles in solids, liquids and gases using styrofoam discs (from packaging material) or cardboard discs. Instructions on how to make the model are given on BLM 3.2.
- Review and discuss students' designs and clarify students' interpretations using some styrofoam discs on an OHP. The discs can be moved around as you describe and explain their movement according to the particle model.

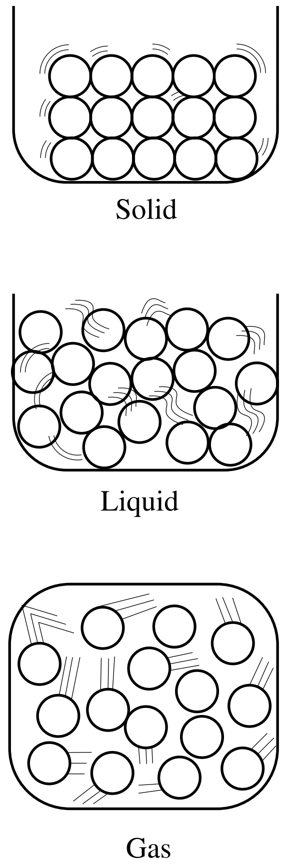
Activity 6

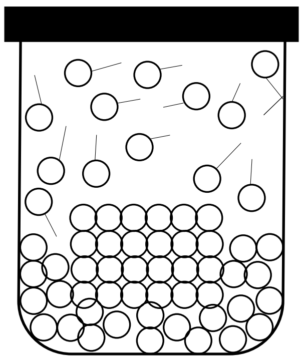
Demonstrating dynamic particle models

Purpose: to further explain the particle model and develop the link between energy of the particles and their state. This will lead to an explanation of change of state.

- Explain the particle theory further by using one of the following experiences:
  - using kinetic theory apparatus to demonstrate kinetic theory of solids, liquids and gases
  - increasing the motion of beads in a flask to model particles in a solid, liquid and gas
  - model with the OHP, as used in Activity 5
  - organising a group of students to model for the class the behaviour of particles in solids, liquids and gases by performing a role-play of particle motion.
- Students complete an exercise to match states of matter with their properties and the behaviour of their particles. [Use either BLM 3.3a (a cut and paste exercise) or BLM 3.3b (a matching exercise which develops the explanation to complete sentences). OHT 3.3c is an answer to BLM3.3b.]

Particle models





A particle representation of ice floating in water in a sealed jar: all states of matter together!

Phase 3: Joint construction

In this phase, students will be supported in writing a successful explanation. Students will use the particle theory to explain the changes of state observed in the water cycle. Students will further develop experimental skills and techniques and increase their understanding of concepts, as they investigate the water cycle.

Activity 7

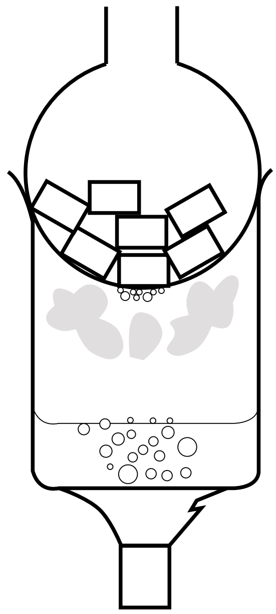
Making a model of the water cycle

Purpose: to reduce and simplify a large-scale and complex process to observable proportions.

- Students make a simple working model of the water cycle using laboratory equipment.

Any suitable model of the water cycle may be used here. For example, sit a 500mL round-bottom flask containing some ice on top of a 500 mL beaker containing 80mL of water. Heat gently.

Ideally, students' observations should be written as annotations around a 2D drawing of the model.



- Students observe and record their observations in their own words.
- Discuss the model with the class.

Point out how the model is similar to what happens in nature [i.e. water heats up and turns into a gas. It goes up into the air above the water layer. The (water) gas changes to small droplets of liquid water and turns into mist. The droplets grow big enough to fall, just like rain.]

Point out how the model is different from what happens in nature (i.e. heat is provided by the Bunsen flame in the model but by the sun in nature. Water boils in the model but does not in nature. The droplets grow on the underside of the cold flask in the model,whereas in nature cold air high in the sky causes this to happen.) Talk about how and where water goes from wet clothes drying on a clothes line and about how water disappears from a puddle or from a jar left out in the sun. Point out that boiling occurs when a lot of water is forced to change to a gas when water is heated strongly.

Activity 8

Using the particle theory to explain the water cycle

Purpose: to assist students to recognise the different ways to represent our understanding of the water cycle. We choose different ways depending on the audience for the text. This activity guides students through different ways of representing the water cycle. It takes students through the steps, from everyday oral explanations to scientifically abstract written explanations (so they can understand the depth of science knowledge contained in them), then assists them to produce a successful written explanation.

- Distribute BLM 3.4a, BLM 3.4b, BLM 3.4c and BLM 3.4d. Tell students that the question marks on BLMs 3.4a to 3.4c represent missing information. BLM 3.4d has boxes containing the missing information. This activity involves them in attaching the missing information to the appropriate BLM.
- Discuss with students the notion that the words we use in speaking are often different from the words we use when we write.
- Display OHT 3.4a. Tell students that the diagram represents an incomplete explanation of the water cycle. Ask students to describe orally in their own words the series of events and things which happen as water cycles in nature.
- Refer students to BLM 3.4d which shows the missing words. Tell students that the missing information from OHT 3.4a is information which we would use if we were speaking to someone who didn't know how water changes its state in the water cycle. Ask students to suggest which words they think would be appropriate for this spoken explanation. Write the missing words on OHT 3.4a.
- Students cut and paste the words for the series of events onto BLM 3.4a.
- Continue leading the students on the OHTs until they appear confident with the activity. Emphasise that the language will change on each different BLM.
- Students complete BLM 3.4b and BLM 3.4c in groups.
- Display OHT 3.4c and show students that most of the words have been removed. This is what happens when we summarise a series of events. In this explanation the words which tell us what is happening are the most important part of the explanation; they are always included in the summary. Ask students which words tell the reader what happens.
- Suggest to students that, in the diagram on OHT 3.4e, a single word now represents the sequence of events which is happening.
- Students copy and complete OHT 3.4e. (Use OHT 3.4f to reinforce the concept and check understanding.)
- Distribute OHT 3.4g.
- Students produce a written explanation by unjumbling the sentences on BLM 3.4g.
- Reinforce the structural and language features of the explanation by labelling the *title, phenomenon identification* and *explanation sequence*; mark the words which link sentences; and point out the use of present tense. (BLM 3.4h is provided as an answer.)

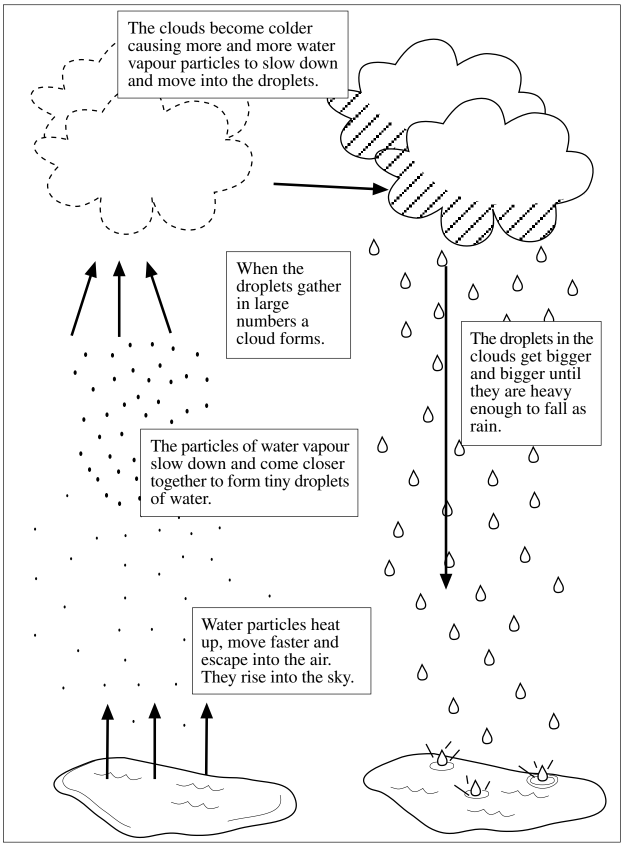
Extension

- Provide students with the first half of the explanation to unjumble and then let them complete the explanation in their own words.

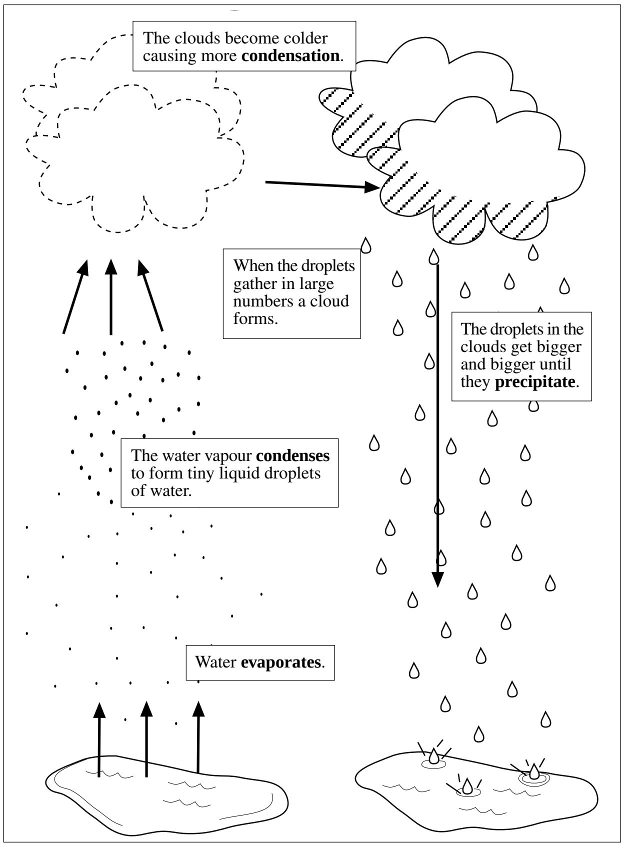
(Acknowledgement: This activity was adapted from an activity designed by Sandra Robinson, Literacy Consultant.)

Answers to BLM/OHT 3.4a, 3.4b, 3.4c

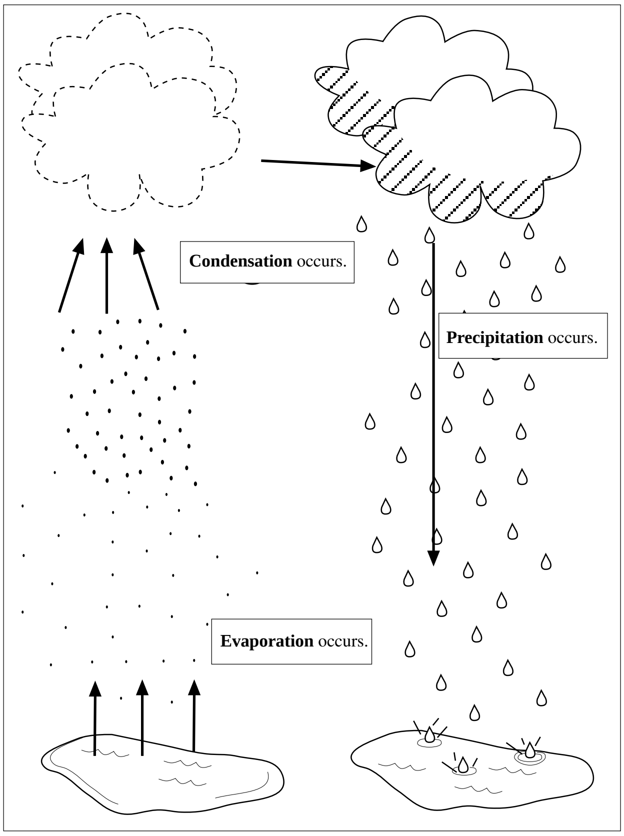
BLM 4a / OHT 4a



BLM 4b / OHT 4b



BLM 4c / OHT 4c



Phase 4: Independent construction

In this phase, students will demonstrate their ability to write a successful explanation in another new but related context. This new context provides the opportunity to further build field knowledge.

Activity 9

Writing an explanation

Purpose: to provide students with an interesting phenomenon to investigate and explain. The camper's survival kit involves only the application of information already examined. The solar still requires students to discover that dissolved salt does not evaporate and condense like water does in the cycle.

- Provide students with BLMs for either the "Survival kit for campers" [BLM 3.5a] or "The solar still" [BLM 3.5b]. Provide the assessment criteria. Describe and clarify the task: *To develop and present an explanation of a water purifying device.*
- Students construct and trial their device.
- Students use the scaffold (BLM 3.6a) to write in their notes while experimenting.

> Consider putting the scaffold on a word processor for students to edit their work.

- Students individually produce a draft explanation using a scaffold (BLM 3.6b).
- Students edit the draft and then have it checked by a peer, before the final presentation.

Task assessment criteria

Student's name:……………………………………………………………………………………

Feature of report	sometimes	usually
Science content accurate		
Simple present tense used		
Technical words used appropriately		
Words linking cause and effect used		
Time links used		
Paragraphs used		
"Title" present		
"Phenomenon identification" present		
"Explanation sequence" present		

- Use the grid above to assess independent constructions.

> Provide feedback to students on structure, sequence, use of connectives by one of the following methods:
> - collecting and marking individual explanations
> - partners conferencing and evaluating each other's work
> - photocopying each group's explanation onto an OHT and using for peer assessment.

Self assessment

Encourage students to:
- *be aware of the assessment criteria*
- *self assess and evaluate their own progress*
- *compare their assessment with that of the teacher.*

BLM 3.1a: Barrier game: connectives missing

How water changes

The three states of matter are solid, liquid and gas. Water exists in the environment in all three states. Water can be a solid (ice), a liquid (water) or a gas (water vapour or steam). To change water from one state to another, it must be heated.

……………… ice is heated in a beaker, it becomes warmer. As warm ice continues to be heated it changes from a solid to a liquid (i.e. it melts) ………… …………… ……………, liquid water forms. When the liquid water is heated further, it becomes hotter and hotter. ……………… the water begins to boil. As the water boils, steam rises from its surface. This is ……………… the boiling water changes into steam. Steam is colourless ………………… appears white when it contains minute droplets of liquid water. When the steam is heated more, it becomes hotter, hotter than the liquid water.

……………… the liquid water evaporates to form water vapour, the water level in the beaker falls and the steam level in the air increases.

………………… the ice is melting or the liquid water is boiling, the water does not become hotter. This is ………………… the heat is used to change the water from one state of matter to another.

BLM 3.1b: Barrier game: verbs missing

How water changes

The three states of matter are solid, liquid and gas. Water ………………… in the environment in all three states. Water can be a solid (ice), a liquid (water) or a gas (water vapour or steam). To change water from one state to another, it must be heated.

When ice ……….. …………………… in a beaker, it becomes warmer. As warm ice continues to be heated it changes from a solid to a liquid (i.e. it melts). As a result, liquid water ………………… . When the liquid water is heated further, it becomes hotter and hotter. Eventually the water ……………… to boil. As the water boils, steam ………………… from its surface. This is because the boiling water changes into steam. Steam is colourless but appears white when it contains minute droplets of liquid water. When the steam is heated more, it ………………… hotter; hotter than the liquid water.

As the liquid water ………………… to form water vapour, the water level in the beaker ………………… and the steam level in the air increases.

While the ice is melting or the liquid water ……………… ………………, the water does not become hotter. This is because the heat is used to change the water from one state of matter to another.

OHT 3.1: Barrier exercise answers for BLM 3.1a and BLM 3.1b

How water changes

The three states of matter are solid, liquid and gas. Water exists in the environment in all three states. Water can be a solid (ice), a liquid (water) or a gas (water vapour or steam). To change water from one state to another, it must be heated.

When ice is heated in a beaker, it becomes warmer. As warm ice continues to be heated it changes from a solid to a liquid (i.e. it melts). As a result, liquid water forms. When the liquid water is heated further, it becomes hotter and hotter. Eventually the water begins to boil. As the water boils, steam rises from its surface. This is because the boiling water changes into steam. Steam is colourless but appears white when it contains minute droplets of liquid water. When the steam is heated more, it becomes hotter; hotter than the liquid water.

As the liquid water evaporates to form water vapour, the water level in the beaker falls and the steam level in the air increases.

While the ice is melting or the liquid water is boiling, the water does not become hotter. This is because the heat is used to change the water from one state of matter to another.

NOTE: Connectives and verbs are underlined here.

Other words migh also be successful in this text, e.g. *falls* could be *drops*; *becomes* could be *gets*.

OHT 3.2a: Text annotated to show some structural and language features of explanation text type; part 1

Title or heading

How water changes

Phenomenon identification

The three states of matter *are* solid, liquid and gas. Water *exists* in the environment in all three states. Water *can be* a solid (ice), a liquid (water) or a gas (water vapour or steam). To change water from one state to another, it must be heated.

Explanation sequence

When ice is heated in a beaker, it *becomes* warmer. As warm ice continues to be heated it changes from a solid to a liquid (i.e. it melts). As a result, liquid water forms. When the liquid water is heated further, it *becomes* hotter and hotter. Eventually the water begins to boil. As the water boils, steam rises from its surface. This is because the boiling water changes into steam. Steam *is* colourless but appears white when it contains minute droplets of liquid water. When the steam is heated more, it *becomes* hotter, hotter than the liquid water.

As the liquid water evaporates to form water vapour, the water level in the beaker falls and the steam level in the air increases.

While the ice is melting or the liquid water is boiling, the water does not become hotter. This is because the heat is used to change the water from one state of matter to another.

Language features

This text has been annotated to show the types of verbs used and technical language used. OHT 3.2b demonstrates the use of connectives and ways of linking concepts and processes through the text.

Annotated for paragraphs 1 and 2 in the text above are:

- linking verbs in the simple present tense, e.g. *are*
- action verbs in the simple present tense, e.g. rises

Try to find other examples of linking and action verbs in the text.

- Technical words or words with special meaning in science are annotated with boxes e.g. state

NOTE: More language features of the explanation text type are annotated on the following BLM.

OHT 3.2b: Text annotated to show some structural and language features of explanation text type; part 2

Title or heading	**How water changes**
Phenomenon identification	The three states of matter are solid, liquid and gas. Water exists in the environment in all three states. Water can be a solid (ice), a liquid (water) or a gas (water vapour or steam). To change water from one state to another, it must be heated.
Explanation sequence	When ice is heated in a beaker, it becomes warmer. As warm ice continues to be heated it changes from a solid to a liquid (i.e. it melts). As a result, liquid water forms. When the liquid water is heated further, it becomes hotter and hotter. Eventually the water begins to boil. As the water boils, steam rises from its surface. This is because the boiling water changes into steam. Steam is colourless but appears white when it contains minute droplets of liquid water. When the steam is heated more, it becomes hotter, hotter than the liquid water. As the liquid water evaporates to form water vapour, the water level in the beaker falls and the steam level in the air increases. While the ice is melting or the liquid water is boiling, the water does not become hotter. This is because the heat is used to change the water from one state of matter to another.

Language features

The annotations in the text above are some examples of how ideas are linked from sentence to sentence. This helps sequencing and to develop relationships within the text.

Annotated in paragraph 2 are:

- linking words to do with "time" e.g. when
- linking words to do with "cause and effect" e.g. As a result
- linking ideas from sentence to sentence

  e.g. becomes warmer. As warm ice
- developing terms from sentence to sentence

  e.g. solid to a liquid... As a result, liquid water forms.

Try to find other examples in this text.

The particle model

Equipment (needed per pair):

glue
scissors (2 pairs)
styrofoam discs (as found in packaging)
3 sheets of cardboard (8cm x 10cm) labelled solids, liquids, gases

Instructions

1. Cut out the information below.
2. Match your information with the heading on each piece of cardboard.
3. Discuss with your partner the position of particles in a solid, ie are the particles close together or far apart?
4. Paste styrofoam discs to represent your model of a solid on your piece of cardboard.
5. Draw arrows to show the movement between the particles.
6. Repeat steps 4 and 5 for liquids and gases.

In a solid, the particles:

- are tightly packed
- remain locked in position
- only shake in their place

In a liquid, the particles:

- are very close together
- shake
- move past each other
- roll over and under each other

In a gas, the particles:

- are a long way apart
- are free to move anywhere in the container
- travel at great speed
- collide with each other
- collide with the walls of their container

References: *Write it Right* (Matter), Science Spectrum 1

BLM 3.3a: A cut-and-paste exercise

Instructions

The boxes below are jumbled. Cut out the *state of matter, property* and *behaviour of particles* boxes below and match them to form sentences to explain the behaviour of solids, liquids and gases.

State of matter	Property	Behaviour of particles
Solids	take the shape of their container	because their particles are close together.
Solids	can be compressed slightly	because their particles are held together less strongly.
Solids	have a constant shape	because their particles can roll over one another.
Liquids	cannot be poured	because their particles are not held together at all.
Liquids	can be poured	because their particles are very far apart.
Liquids	spread out quickly	because their particles are not free to move.
Gases	cannot be compressed	because their particles are free to move.
Gases	are easily compressed	because their particles are held together strongly.
Gases	take the shape of their container	because their particles are as close together as they can be.

BLM 3.3b: Synthesising an explanation

The three states of matter and behaviour of particles

Instructions

1. Match information from each column in the table below by joining dots across the columns.
2. Complete the sentences below the table by transferring the information matched in the table.

Note: An example has been completed for you.

The properties of solids, liquids and gases and the way the particles behave

State of matter	Property	Behaviour of particles
Solids •	• take the shape of their container •	• are close together.
	• can be compressed slightly •	• are held less strongly.
	• have a constant shape •	• are close together.
	• cannot be poured •	• are not held together at all.
Liquids •	• can be poured •	• are very far apart.
	• spread out quickly •	• are not free to move.
	• cannot be compressed •	• are free to move.
Gases •	• are easily compressed •	• are held together strongly.
	• take the shape of their container •	• are as close together as they can be.

(State of matter) **(property)**........ because their particles ..**(behaviour of particles)**......

For example:

Solids have a constant shape....... because their particles ..*are held together strongly.*...

.... because their particles ....

.... because their particles ....

.... because their particles ....

.... because their particles ....

.... because their particles ....

Gases ....

Gases ....

Gases ....

BLM 3.3c: Answer to BLM 3.3b

The three states of matter and behaviour of particles

Instructions

1. Match information from each column in the table below by joining dots across the columns.
2. Complete the sentences below the table by transferring the information matched in the table.

Note: An example has been completed for you.

The properties of solids, liquids and gases and the way the particles behave

State of matter	Property	Behaviour of particles
Solids	take the shape of their container	are close together.
	can be compressed slightly	are held less strongly.
	have a constant shape	can roll over one another.
	cannot be poured	are not held together at all.
Liquids	can be poured	are very far apart.
	spread out quickly	are not free to move.
	cannot be compressed	are free to move.
Gases	are easily compressed	are held together strongly.
	take the shape of their container	are as close together as they can be.

(State of matter) (property)........ because their particles (behaviour of particles)......

For example:

Solids have a constant shape .... because their particles *are held together strongly.*

Solids cannot be poured .... because their particles *are not free to move.*

Solids cannot be compressed .... because their particles *are as close together as they can be.*

Liquids take the shape of their container because their particles *are held less strongly.*

Liquids can be compressed slightly .... because their particles *are close together.*

Liquids can be poured .... because their particles *can roll over one another.*

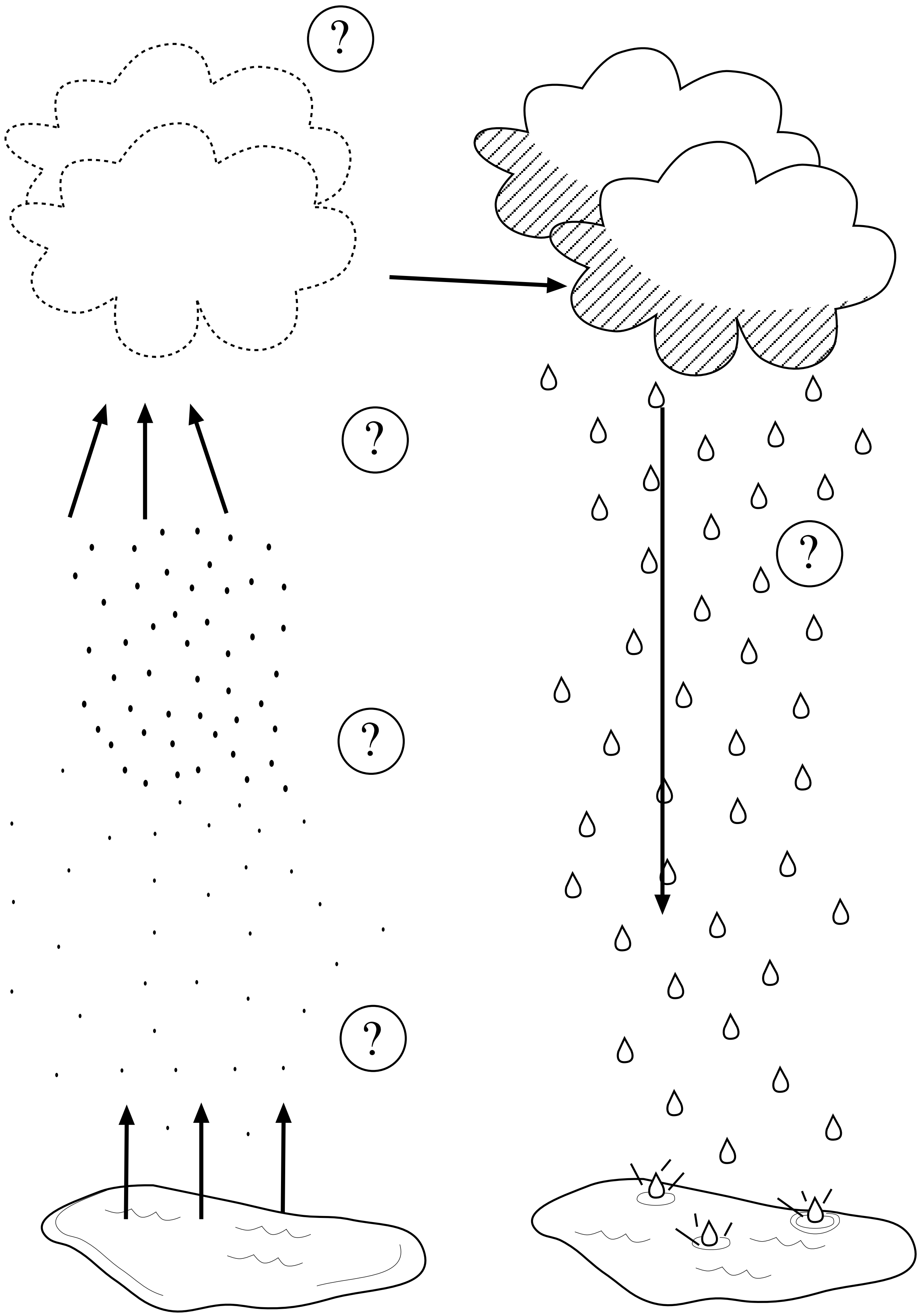
Gases *spread out quickly because their particles are free to move.*

Gases *are easily compressed because their particles are very far apart.*

Gases *take the shape of their container because their particles are not held together at all.*

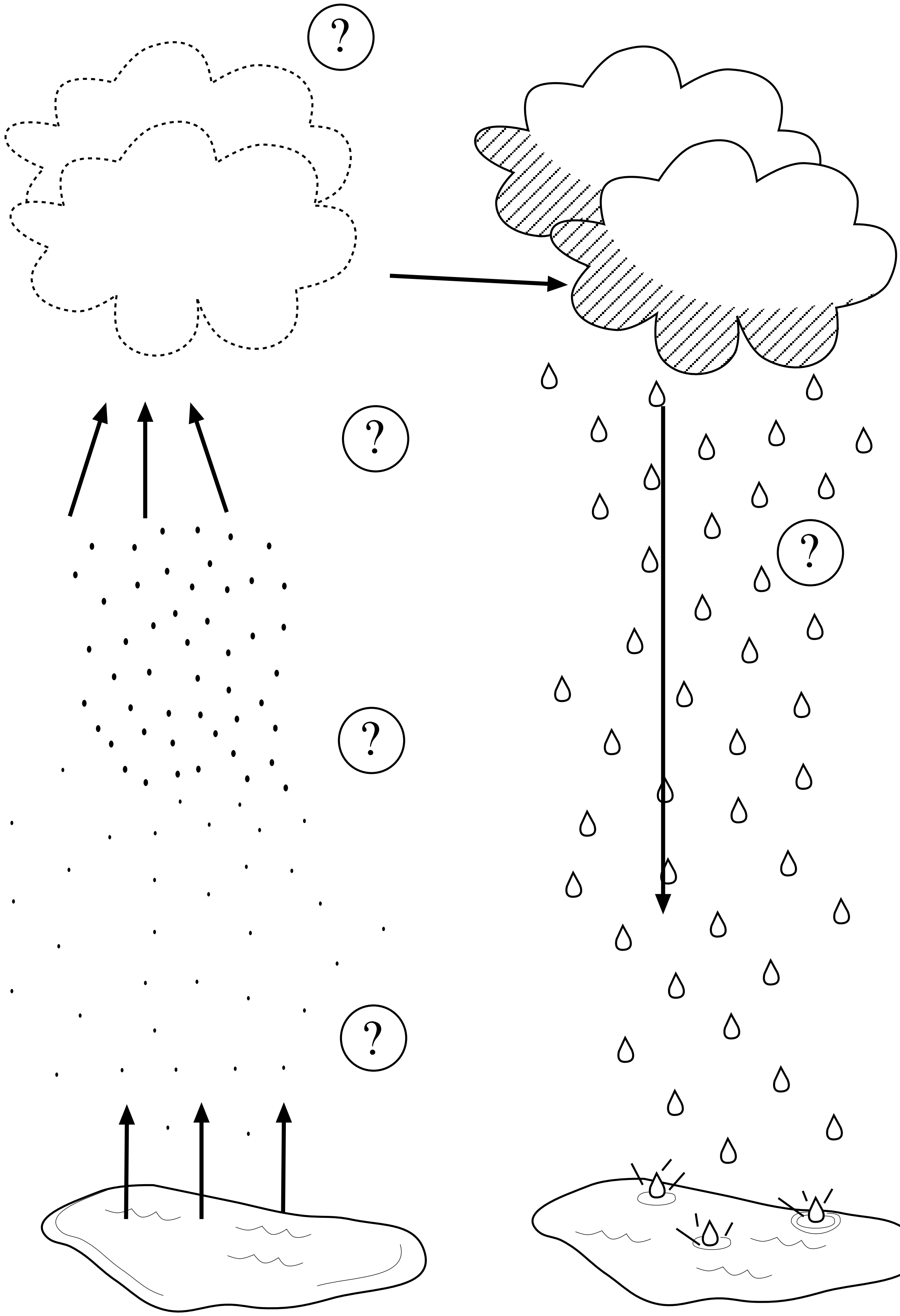
BLM 3.4a/OHT 3.4a: Base sheet for activity 8

The water cycle as we would explain it orally to someone who didn't know anything about it.



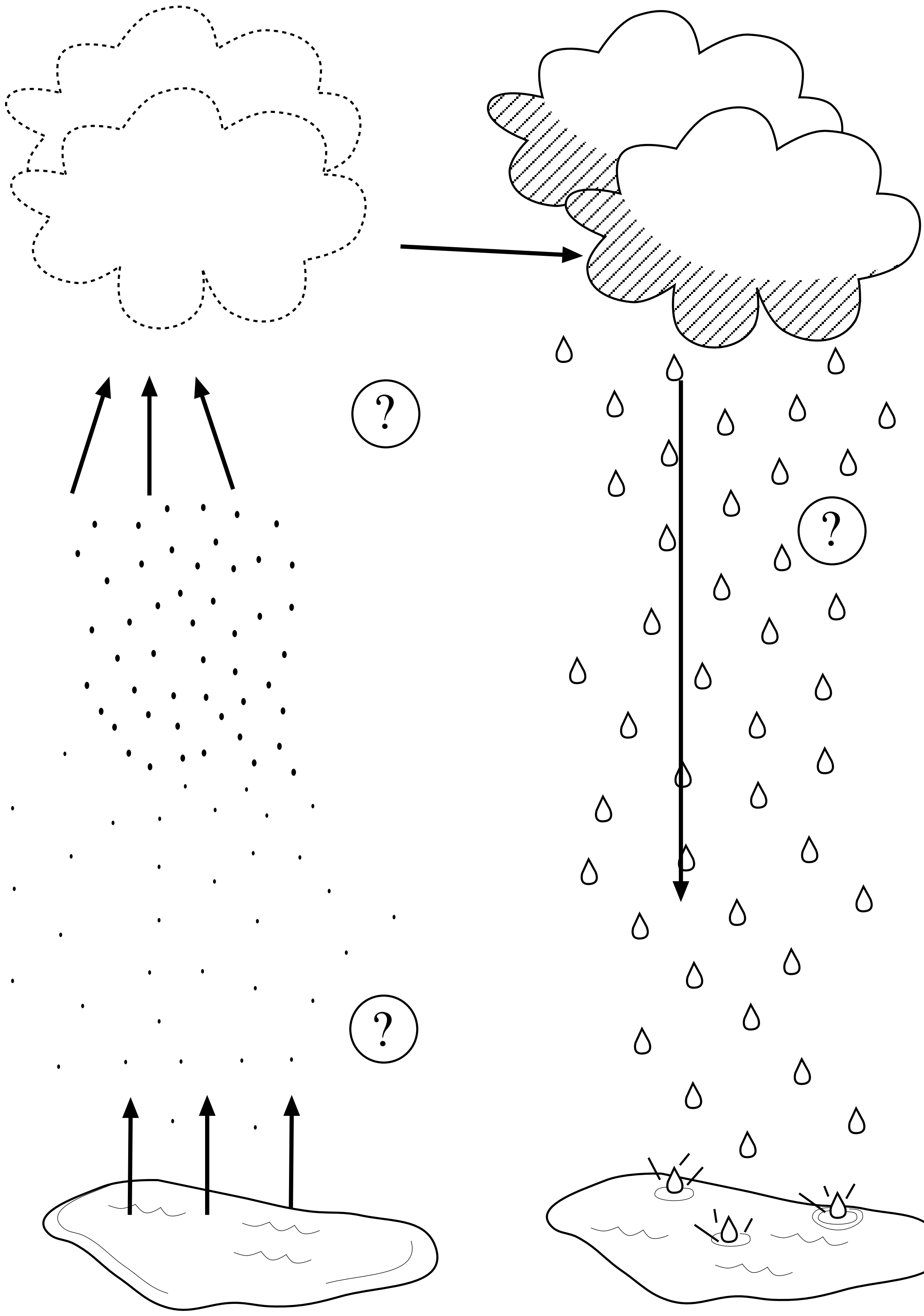
BLM 3.4b/OHT 3.4b: Base sheet for activity 8

The water cycle, introducing scientific terms into the sentences to explain what is happening. A more scientific summary of the water cycle.



BLM 3.4c/OHT 3.4c: Base sheet for activity 8

An even more scientific written summary of the water cycle which does not use long sentences.

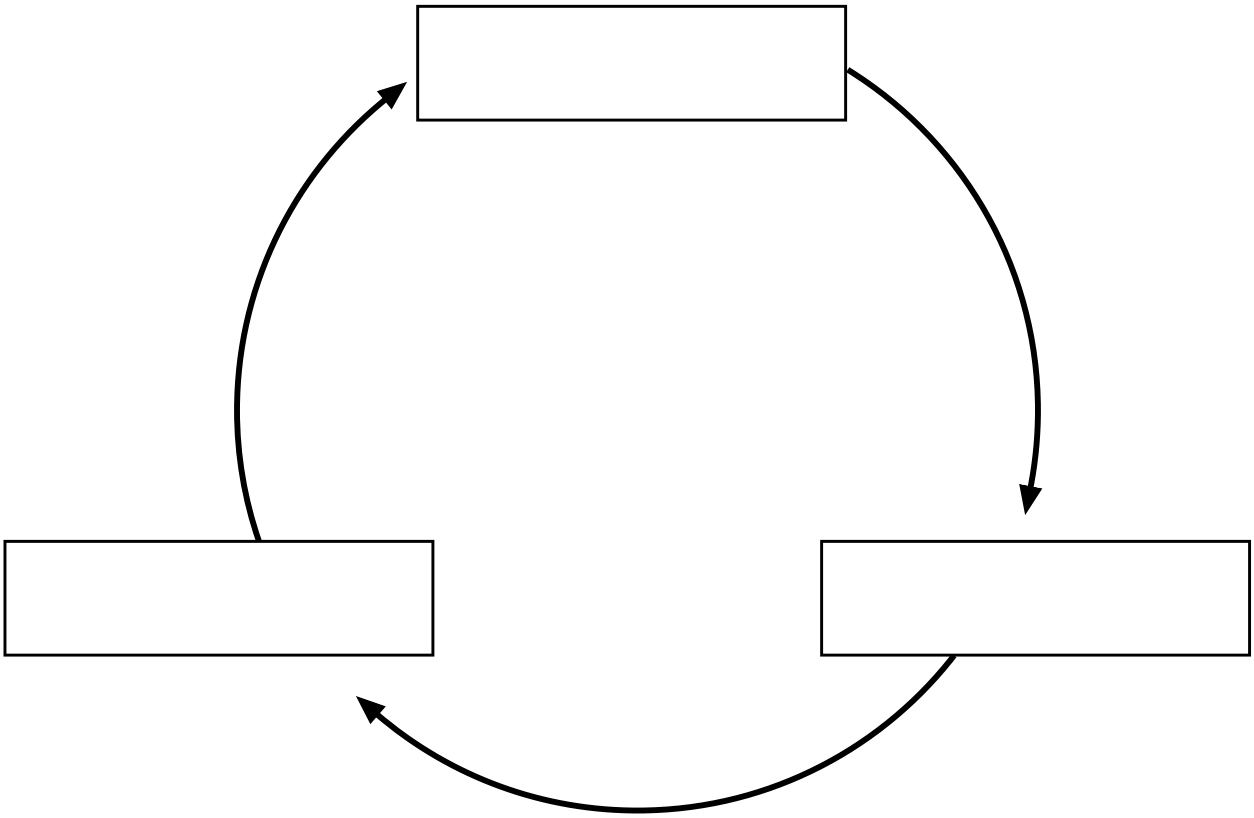


BLM 3.4d: Jumbled labels for water cycle base sheet for activity 8

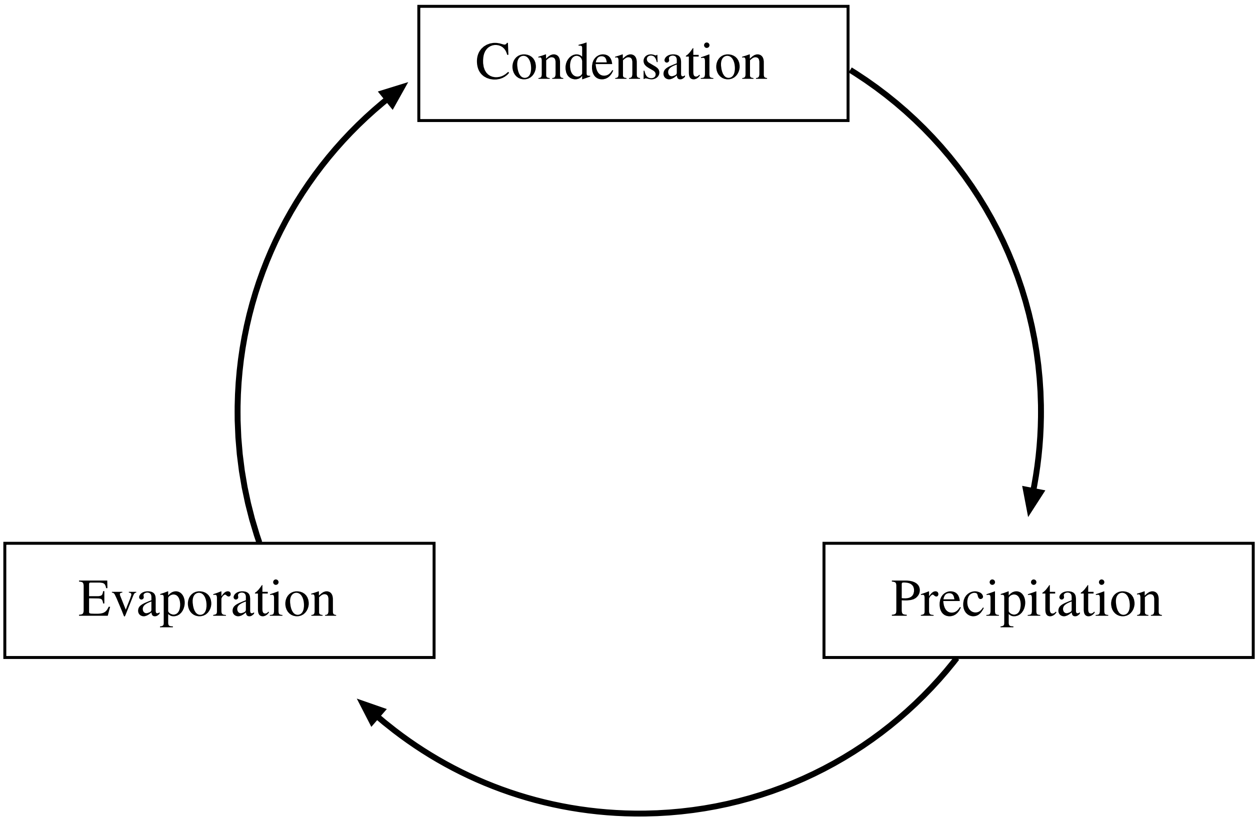
Cut out these boxes and use them on BLMs 3.4a to 3.4c

When the droplets gather in large numbers a cloud forms.	The clouds become colder causing more **condensation**.	Water **evaporates**.
The particles of water vapour slow down and come closer together to form tiny droplets of water.	The droplets in the clouds get bigger and bigger until they are heavy enough to fall as rain.	The water vapour **condenses** to form tiny liquid droplets of water.
Evaporation occurs.	When the droplets gather in large numbers a cloud forms.	The clouds become colder causing more and more water vapour particles to slow down and move into the droplets.
Water particles heat up, move faster and escape into the air. They rise into the sky.	The droplets in the clouds get bigger and bigger until they **precipitate**.	**Precipitation** occurs.
Condensation occurs.		

OHT 3.4e: A scientific diagram representing the water cycle



OHT 3.4f: Answer for OHT 4e



BLM 3.4g: Worksheet

Explaining the water cycle

Unjumble the following explanation:

Cut out the following sentences and paste them in the correct order to produce an explanation of the water cycle.

A. High in the sky, the temperature is cold.

B. When these droplets gather in large numbers a cloud forms.

C. The heat from the sun causes water in the puddle to change from liquid to gas.

D. The particles, now called water vapour particles, are moving fast and therefore are spread out so much from each other that we cannot see them.

E. Inside the cloud, small droplets of water may also join together to form raindrops.

F. When the raindrops fall the process is known as **precipitation**.

G. This process is known as **coalescence**.

H. This causes the water vapour particles to slow down and come close together.

I. This process is called **evaporation**.

J. **The water cycle**.

K. This process is known as **condensation**.

L. Eventually enough vapour particles come together to form tiny droplets of water.

M. The water vapour particles rise high in the sky.

N. This causes more and more vapour to condense, producing raindrops.

O. Some particles of water move fast enough to escape from the surface of the puddle.

P. These raindrops may fall from the clouds as rain.

Q. If the clouds rise higher into the sky, they become much colder.

R. Precipitation returns water to the Earth's surface.

S. Water is constantly moving between the Earth's surface and the atmosphere. This process is called the water cycle.

BLM 3.4h: Answer for BLM 3.4g

Explaining the water cycle

Title	J	**The water cycle**.
Phenomenon identification	S	Water is constantly moving between the Earth's surface and the atmosphere. This process is called the water cycle.
Explanation sequence	C	The heat from the sun causes water in the puddle to change from liquid to gas.
	O	Some particles of water move fast enough to escape from the surface of the puddle.
	I	This process is called **evaporation**.
	D	The particles, now called water vapour particles, are moving fast and therefore are spread out so much from each other that we cannot see them.
	M	The water vapour particles rise high in the sky.
	A	High in the sky, the temperature is cold.
	H	This causes the water vapour particles to slow down and come close together.
	L	Eventually enough vapour particles come together to form tiny droplets of water.
	K	This process is known as **condensation**.
	B	When these droplets gather in large numbers a cloud forms.
	Q	If the clouds rise higher into the sky, they become much colder.
	N	This causes more and more vapour to condense, producing raindrops.
	E	Inside the cloud, small droplets of water may also join together to form raindrops.
	G	This process is known as **coalescence**.
	P	These raindrops may fall from the clouds as rain.
	F	When the raindrops fall the process is known as **precipitation**.
	R	Precipitation returns water to the Earth's surface.

BLM 3.5a: Assessment of explanation text

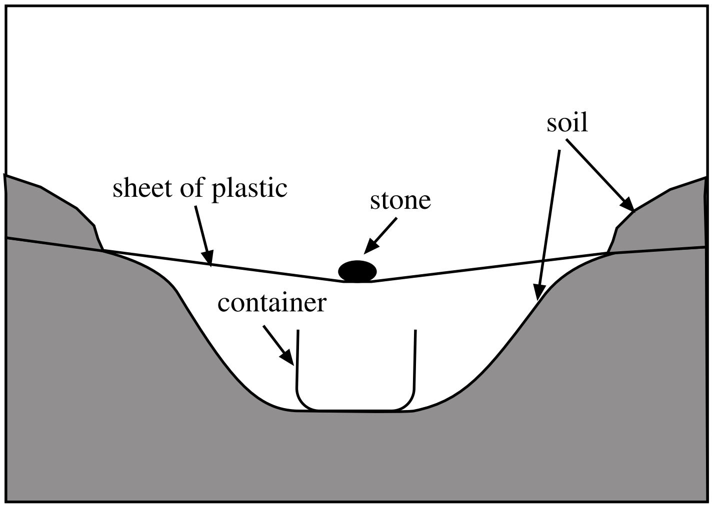
Survival kit for campers

While on vacation, a group of campers decided to collect some fresh water by using the following method, which they had read about in a survival guide for campers. Study carefully the instructions and diagram given to the campers in the guide. Set up and trial a similar device. Explain in half a page how the survival kit works.

To make the survival kit you will need:

- 1 spade
- 1 sheet of black plastic, about 1 metre square
- 1 container
- 1 stone

1. Dig a hole in the ground about 40 centimetres deep and about 20 centimetres smaller in diameter than the plastic sheet.
2. Place the container in the centre of the hole.
3. Put the plastic sheet over the hole. Put soil on the edges of the sheet to prevent it from slipping into the hole.
4. Rest the stone in the centre of the sheet over the container.



5. Leave for the day or overnight and then remove the sheet and examine its underside, and the container.

If you want to increase your water supply, you could add anything that might contain water – leaves, twigs, salt water, or even human urine.

Some survival kits include a plastic hose. This allows water to be sucked from the container without dismantling the kit.

Adapted from *Water*, Australian Science Education Project (ASEP). Victoria, 1969.

A solar still

Seawater contains salt. The salt in sea water may be removed by using the solar still pictured below. Study the diagram carefully. Make and trial such a device. Explain in half a page how the solar still works.

A solar still

Insert pic of solar still

Good sealing is necessary between the black and clear plastic, and between the funnel and plastic.

When constructed, place the solar still in the sunshine.

Adapted from *Water*, Australian Science Education Project (ASEP). Victoria, 1969.

BLM 3.6a: Scaffold for note taking in preparation for writing an explanation

Title or heading	....
Phenomenon identification *What is the device and what is it used for?*	
Explanation sequence *Draw a labelled, 2D diagram of the device.*	
Describe the device.	
How does the device work?	

BLM 3.6b: Scaffold for an explanation

Title or heading ....

Phenomenon identification

Write a general statement telling the reader the name of the device and what it is used for

Explanation sequence

Write a description of the device and its purpose.

Draw a labelled, 2D diagram of the device.

Write to explain how the device works.

Unit four: Water management

Text type focus: Exposition

Introduction

Rationale

Because this unit builds on an understanding of the report and explanation text types, it is recommended that the unit be used only after students are familiar with reports and explanations.

Explicitly recognising and identifying structural and language features will assist students to understand and respond appropriately when listening to and reading expositions and will help them to write successful expositions.

This unit highlights:

- the recognition of organisational elements of expositions;
- the use of the simple present tense;
- the use of connectives of time and cause-and-effect;
- paragraph structure demonstrating point and elaboration;
- the use of words which qualify; and
- the use of nominalisation.

The aims of this unit are:

- to identify and explore issues of water quality and its conservation, both locally and in the broader Australian community
- to enable students to produce appropriate arguments through activities that focus on the structures and grammatical features of expositions
- (optional) to enable students to retrieve and evaluate information from the Internet.

Learning outcomes

Students will be able to:

- construct arguments relating to the issues of water quality and conservation (Literacy)
- extract information from a variety of sources (Science 7-10)
- appreciate that science and technology have an impact on society and the environment (Science 7-10)
- show a lively interest in the nature and behaviour of people and the environment (Science 7-10)
- present information and ideas in short written and oral reports (Science 7-10)
- manipulate simple laboratory and field apparatus and other equipment commonly available in schools (Science 7-10)
- work effectively in groups (Science 7-10).

Features of this unit

Internet references in the form of bookmarks are provided to help students to gain access to information they need for independent research.

All the activities listed throughout the unit of work are designed to continually build field knowledge.

Vocabulary

exposition, argue, argument, discussion, explanation, connective, temperature, quality, acidity, clarity, pollutants, organisms, conservation, sewerage, sewage

Overview

Unit 4: Water Management — **Text type: Expositions**

Phase of the teaching/learning cycle	Learning activity	Language emphasis	Resources	Learning indicators Students can:	Assessment suggestions
Determining prior learning	Activity 1. Observation: Revising reports. • Student investigation and description of a local body of water; use of living organisms as a guide to water quality • Student note taking using a scaffold • Student use of the Internet to download information from *Streamwatch*	• descriptive report writing	BLM 4.1 Internet bookmark: http://www.streamwatch.aus.net/	• analyse a water sample • devise a measure of water quality • write in paragraphs • use diagrams to support descriptions • use the Internet to download information from *Streamwatch* • work cooperatively in a group	• Assessment of written report
	Activity 2. Cause and effect: Revising. • Student sequencing exercise • Student cloze exercise • Group activity to construct a concept map	• reading and comprehension • revision of explanations • use of connectives	BLM 4.2a OHT 4.2a BLM 4.2b OHT 4.2b	• explain the action of pollutants on water quality • sequence events in an explanation • use appropriate connectives in an explanation	• Comprehension test • Jumbled sentences • Cloze passage
Modelling	Activity 3. Modelling expositions. • Teacher presentation and explanation of the structure and purpose of a model exposition, *Mulching* • The benefits of mulching your garden	• modelling expositions • structural components of exposition	BLM 4.3 OHT 4.3	• identify the structure and purpose of expositions • identify ways to conserve water in the garden	• Class discussion
Joint construction	Activity 4. Water conservation and quality. • Students' use of Internet bookmarks to research methods of water conservation • Group creation of an exposition • Student presentation of work to class using OHT	• creating expositions • purpose of text driven by structure and grammar • modality • emphasis on structural components of exposition	Bookmarks http://www.epa.gov/OGDW/kids/bloopers.html http://www.cabq.gov/resources/index.html http://www.abc.net.au/btn/ http://www.erin.gov.au/index/html http://www.ozemail.com.au/-hncmt/ http://www.awwa.asn.au/ http://www.peg.apc.org/-ozgreen/	• log onto the Internet • explain the need for water conservation • produce an exposition that has recognisable stages • identify the purpose of an exposition • work cooperatively in a group • work cooperatively with a partner	• Teacher observation • Assessment of draft exposition • Class discussion (can be assessed later) • Assessment of group presentations

Page 2 of 2

Unit 4: Water Management — **Text type: Expositions**

Phase of the teaching/ learning cycle	Learning activity	Language emphasis	Resources	Learning indicators Students can:	Assessment suggestions
Joint construction (continued)	Activity 5. Qualifying statements. • Teacher-led discussion of qualifiers • Student evaluation and modification of an exposition	• qualifiers used as rhetorical devices to position the reader • grammar of argument		• qualify statements	• Class discussion • Assessment of written drafts
	Activity 6. Putting it all together: complex texts. • Student drafting of an exposition on the issue of blue-green algae • Teacher-led discussion of student drafts and an example: *Blue-green algae* • Students edit drafts to produce an exposition	• most factual texts are an amalgam of simpler text types because they must perform a variety of functions		• write a text composed of more than one text type	• Assessment of written drafts
	Activity 7. Managing water resources. • Teacher presentation of the process of nominalisation • Student transformation of verbs to nouns to produce more scientific explanations	• transforming spoken mode to written mode	BLM 4.4a BLM 4.4b	• nominalise verbs	• Assessment of edited texts
Independent construction	Activity 8. Sewage pollution. • Student research on sewage pollution • Teacher-led discussion of issue • Student construction of an exposition using a scaffold	• features of an exposition	Bookmarks (see Teacher notes)	• describe, analyse and evaluate human impact on the environment • write an exposition about a specific issue related to sewage pollution	• Assessment of edited texts

Map linking learning indicators to outcomes

This map can be used to assist you in determining the extent to which students have achieved outcomes of the Science 7-10 syllabus and in literacy.

Unit 4: Water Management	**Text type: Expositions**
Learning outcomes Students will be able to:	**Learning indicators** Students can:
construct arguments relating to the issues of water quality and water conservation (Literacy) *and* present information and ideas in short written and oral reports (Science 7-10)	• write in paragraphs • use diagrams to support descriptions • sequence events in an explanation • use appropriate connectives in an explanation • identify the structure and purpose of expositions • produce an exposition that has recognisable stages • identify the purpose of an exposition • qualify statements • write a text composed of more than one text type • nominalise verbs • write an exposition about a specific issue related to sewage pollution
extract information from a variety of sources (Science 7-10)	• log onto the Internet • use the Internet to download information from *Streamwatch*
appreciate that science and technology have an impact on society and the environment (Science 7-10) show a lively interest in the nature and behaviour of people and the environment (Science 7-10)	• explain the action of pollutants on water quality • identify ways to conserve water in the garden • explain the need for water conservation • describe, analyse and evaluate human activities which may impact on the environment
manipulate simple laboratory and field apparatus and other equipment commonly available in a school	• analyse a water sample • devise a measure of water quality
work effectively in groups (Science 7-10)	• work cooperatively in a group • work cooperatively with a partner

Teaching notes

Phase 1: Determining prior learning

The two activities of this phase provide opportunities for you to assess students' field knowledge.

The activities are also devised to build background knowledge and awareness of some of the issues relating to water management. The activities involve constructing knowledge in the form of reports (descriptions) and explanations. Students will need to be able to understand and use these texts effectively in order to write successful expositions.

Activity 1

Observation: revising reports

Purpose: Descriptive texts are used to build field knowledge. Students need to recognise the features of reports that contribute to students being able to write successful expositions.

- Discuss the use of a scaffold (BLM 4.1) to guide notetaking.
- Students observe and describe the quality of a local body of water e.g. river, lake, pond, ocean, etc. in terms of quality by analysing open water. Students use BLM 4.1. (Where access to open water is a problem, consider using a bucket of the water as the water to be analysed and modifying the BLMs.)

  Students describe such features as water temperature, flow, clarity, types and amounts of pollutants, types and amounts of living organisms, etc. (Consult science textbooks for procedures for taking measurements.)
- Students record the activity by writing a report from their notes.

Quality can be determined by firstly describing the living organisms in the water, then using index organisms to ascertain quality. See *Streamwatch* for suggestions.

http://www.streamwatch.aus.net/

Streamwatch NSW (Waterbug survey) With a comprehensive description of water bugs, this site explains how the health of waterways can be determined by the types of bugs that live in them.

Text type: Report

Reports are essentially descriptions that classify and describe things in general and specific terms.

Structure of reports

Reports are frequently structured in the following way:

Classification

This section of the text classifies the thing being described, locates it in time and space and/or previews the rest of the description to follow.

Description

Feature 1
Feature 2
Feature 3
etc.

Typically, the description will consist of paragraphs, each dealing with a different feature.

Activity 2

Cause and effect: revising explanations

Purpose: Explanatory texts are used to build field knowledge. Students need to recognise the features of explanations that contribute to successful expositions. Note: There is an emphasis on †connectives which demonstrate time and cause-and-effect because these connectives effectively link arguments together, giving the impression of a strong case.

- Students complete questions on BLM 4.2a.
- Emphasise that successful explanations rely on:
  - (a) using words which show cause-and-effect, e.g. connectives such as *therefore, because;* nouns such as *the result;* verbs such as *causes*
  - (b) using words expressing time, such as *after a while*, *now*, *then*;
  - (c) having events ordered in time.
- Use BLM 4.2b, *Bacterial regrowth in water pipes*, as a model explanation.
- Students complete exercises on BLM 4.2b. They use the list of connectives given on BLM 4.2b to complete the task.
- Use OHT 4.2b to discuss with students the structure and language features of *Bacterial regrowth in water pipes.*
- Students construct a concept map based on the text demonstrating cause-and-effect. It may be useful for you to start the students off by discussing and drawing up the beginning of a concept map. (For further information about Concept maps, see Unit two: Properties of water.)

Text type: Explanation

Structure of explanations

When writing explanations it is important to remember that they have a special structure. These are the main parts of an explanation:

1. *The **title** or heading (sometimes part of 2).*
2. *The **phenomenon identification**. This is a general statement telling the reader what is being explained.*
3. *The **explanation sequence**. This is the main part of the explanation. There are usually a number of paragraphs, but it could be contained in one paragraph.*

The language that is used in explanations has special features, e.g.:

1. *Use of technical words.*
2. *Use cause-and-effect connectives, for example, words such as "because", "as a result of", "causes".*
3. *Use of time connectives, for example, words such as "after", "following", "then, "next", "initially".*

† Connectives which demonstrate time sequence, e.g. "firstly", "after", "before", "meanwhile", etc.

† Connectives which demonstrate cause and effect, e.g. "therefore", "this results in", "as a consequence of", "because", etc.

Phase 2: Modelling

Expositions are used to analyse, interpret and evaluate the world around us. Expositions are arguments that present only one side of an issue. They are most often found as "letters to the editor" as published in newspapers. The following activities are designed to deconstruct expositions and to reveal their structure and some of their grammatical features. The activities are also designed to further build field knowledge.

Activity 3

Modelling expositions

Purpose: to demonstrate to students the purpose and usefulness of expositions.

- Discuss expositions with the class.

> If we wish to persuade others of a point of view, then we may want to present actions not as imperatives, e.g. "Do what I say", as used in procedures, but as arguments, as used in expositions.

- Present class with model exposition, "The benefits of mulching your garden", BLM 4.3.
- Give the class the following scaffold for an exposition.

Text type: Exposition

An **exposition** has the following parts

1. **Thesis***
   (i) Position: What is the writer's point of view?
   (ii) Preview (optional): What arguments will I use?
2. **Argument 1**
   (i) Point: What is this argument about?
   (ii) Elaboration: How do I argue my point?
   (iii) Summary: Does my argument support the thesis?
   Argument 2
   (i) Point : What is this argument about?
   (ii) Elaboration: How do I argue my point?
   (iii) Summary: Does my argument support the thesis?
   Argument 3… etc.
3. **Reinforcement of the thesis**
   (i) Summary (optional)
   (ii) Reiteration of thesis
   (iii) Recommendation (optional)

***Thesis**

A theory maintained in an argument.

- Model language features, using the annotated OHT 4.3.
- Point out
  - use of the simple present tense
  - use of connectives which demonstrate cause-and-effect, e.g. *hence, because*
  - paragraph structure demonstrating point and elaboration
  - a line left between each paragraph
  - each paragraph is a new argument.

Discuss the purpose of expositions, their structure, how they are different from explanations, the similarities with explanations.

Phase 3: Joint construction

In this phase students attempt to write an explanation with the support of the teacher and other students. They may write as individuals or groups, whatever the teacher sees as appropriate. In practice the students may be at many stages: some may need a lot of guidance, others will need little and may be capable of working independently.

Characteristically, some students may have grasped quickly the structural components of the text type, but some of the grammatical features will still need to be modelled for them.

The writing process involves collecting information, organising the information, drafting a text and finally editing the draft before presentation. The teacher may present the class with activities to build field knowledge, and, after a short discussion of expectations, the students produce a draft. The students are then called upon to present their drafts to the class (or maybe just to the teacher), where editing of the language and the points of the argument are discussed before the students complete a final, edited version for homework.

As the students become more proficient at writing, the process of joint construction becomes a valuable tool to enable learners to reflect upon their work and think with greater clarity. Students' written work also provides a valuable insight into their minds, allowing teachers to identify misconceptions.

Activity 4

Water conservation and quality

Purpose: to support students' understanding of the structure of an exposition as they develop their own group exposition.

- Students work in groups to construct an exposition with the following title:

  "You can make a difference in improving water quality".

- Encourage students to choose a real or fictitious scenario (e.g. letter to the editor, leaflet for a letter box drop, etc.) so they can consider the audience and purpose of the exposition.
- Use the Internet to download *Bloopers*: http://www.epa.gov/OGWDW/kids/bloopers.html
- Alternatively, use a class discussion; consider:
  - waste disposal
  - leaking taps
  - garden watering practices.

> http://www.cabq.gov/resources/index.html
>
> A detailed, but easy to follow presentation of how the US city of Albuquerque is dealing with its water conservation problem. It includes procedures for saving water outside and inside the home.

Group work

How can it be used effectively?

Student talk in small groups provides opportunities for them to connect past and present experiences and to make sense of new information.

This is less threatening than having to commit themselves in front of the whole class or in writing.

Talk in groups has the potential to engage more students than whole-class discussion. Talking about the topic in groups will also allow students to learn from each other. Talk about ideas is a precursor to effective writing about the ideas.

To make group work effective

Ensure students are clearly aware of the tasks and expected outcomes. Setting time guidelines will provide a little positive stress to assist the group to stay on task.

- Provide students with a scaffold of the basic structure of expositions (found in Activity 3). This may be reviewed on the chalkboard or OHP.
- Emphasise that the purpose of the text will often determine its structure. Discuss the differences and similarities between expositions and procedures:
  - purpose of procedure: to instruct someone to do something
  - purpose of exposition: to persuade the reader to a particular point of view. Therefore, arguments within expositions must contain a reason for each point.
- Students edit their text so that it has the structure of a typical exposition.
- Students present their group exposition on OHTs to the class. Class members make comments to assist in editing work.

Activity 5

Qualifying statements

Purpose: to develop students' understanding of the use of qualifiers in arguments.

- Guide a class discussion about the purpose and ways in which a view or position can be qualified. The ability to express degrees of probability, obligation or certainty is often referred to as *modality*. Modality can be expressed through various language features such as:
  – modal verbs, e.g. *might, must*
  – modal adverbs, e.g. *possibly, probably*
  – modal nouns, e.g. *possibility, certainty*
  – modal adjectives, e.g. *probable, usual.*

Students often feel the need for absolute closure in a scientific argument when it is not always justified. Scientific evidence does not always prove or disprove a case.

The following example demonstrates some options available on the continuum between positive and negative statements.

– *It always proves the case.*
– *It usually proves the case.*
– *It often proves the case.*
– *It sometimes proves the case.*
– *It possibly disproves the case.*
– *It may disprove the case.*
– *It rarely proves the case.*
– *It hardly ever proves the case.*
– *It can never prove the case.*

- Students consider the difference between the two statements:

  Irrigation will lead to a reduction in the water levels of rivers.

  Irrigation can lead to a reduction in the water levels of rivers.

- Direct students to modify the exposition drafted in Activity 4.
- Students should examine their own arguments and consider the use of qualifying statements.

Activity 6

Putting it all together: complex texts

Purpose: to demonstrate the value of modelling and editing in producing successful expositions. This activity attempts to model ideas, using students' work.

- Discuss with the class the use of descriptions and explanations in the construction of successful arguments.

Many written essays on particular issues contain a mixture of text types. This is because the essay must perform a number of functions. For example, a written report exploring the issue of blue-green algae outbreaks along our rivers and waterways can go through three stages:

Description What is a blue-green algal bloom?

Explanation What causes the problem?
How can the problem be prevented?

Argument Why should the problem be prevented?

Each of these stages may be expressed in only one paragraph. An exposition will often achieve its purpose (to convince by arguing) by using descriptions and explanations as well as persuasive language.

Note: A straight exposition would not be effective with an audience that knew nothing of the issue. The essay must build field knowledge for the reader before an argument suggesting how to solve the problem can be proposed.

Bookmarks

http://www.abc.net.au/btn/
Behind the News: contains summaries of programs over the past three years. Has a very useful search engine.

http://www.erin.gov.au/index.html
Environment Australia On-line

http://www.ozemail.com.au/~hncmt/
Hawkesbury-Nepean Catchment Management Trust: Search topics such as: Algae, Health of the river, What you can do.

http://www.awwa.asn.au/
Australian Water and Wastewater Association: Good short discussion issues.

http://www.waterwatch.org.au/
Waterwatch Australia

http://www.peg.apc.org/~ozgreen/
Contact schools along the Murray-Darling rivers.

- Students prepare an exposition on the issue of blue-green algae.

Suggested structure:

- What is a blue-green algal bloom?
- What causes the problem?
- How can the problem be prevented?
- Why should the problem be prevented?

- Students produce a first draft of their texts, then use these to discuss with the teacher and other students some grammatical points, e.g. the use of connectives and words which qualify a position.

Activity 7

Managing water resources

Purpose: to introduce the notion of nominalisation to move student arguments from spoken style towards written style.

This activity provides an opportunity for students to use a word processor for editing.

- Ask students to identify the verbs they have used in their own drafts of texts from Activity 6. Use the following text as an example (see also BLM 4.4a)

> *This government has* ***managed*** *our water resources poorly. Our rivers and oceans* ***are being polluted*** *more and more.*
>
> *Toxic algal blooms* ***threaten*** *the Hawkesbury-Nepean and Murray-Darling rivers. Farmers who* ***irrigate*** *with too much water* ***cause*** *algal blooms. When farmers* ***use*** *so much water, only a little* ***is*** *left in the rivers, where it* ***stagnates****. Also, when they* ***irrigate*** *with too much water, water that* ***runs off carries*** *dissolved phosphorus and nitrogen fertilisers back into the rivers. Still waters with a high nutrient content* ***produce*** *perfect conditions for algal blooms. Farmers who wastefully* ***irrigate*** *their land must* ***change*** *if we* ***are going to reduce*** *the number of algal blooms in our rivers.*

Note: **Verbs** are in bold print.

> **Nominalisation**
>
> *Nominalisation is the process of making nouns from verbs or clauses. It makes the writing appear more authoritative and objective by allowing agents to be removed from the action, e.g.* Park rangers have been forced to cull a number of koalas… *becomes* The culling of koalas in National Parks…
>
> *It also allows information to be condensed and placed first in the sentence, e.g.* The government has managed our resources… *becomes* Resource management…
>
> *Nominalisation is a key feature of scientific writing and therefore needs to be understood by students so that they can read scientific texts with understanding and create their own "expert" sounding texts. The overuse of nominalisation can, however, make texts very dense and difficult to understand.*

- Ask students to transform the action verbs into nouns (nominalisation), where possible. Using nouns instead of verbs makes the style more similar to written text.

verb	noun
managed	management
polluted	pollution
irrigate	irrigation
stagnate	stagnation
reduce	reduction
runs off	runoff

- Provide examples of the same text:

  (a) in spoken mode

  (b) in written mode

  and discuss the effect.

The full exposition is given on BLM 4.4b (see "letter to the editor").

For example "*The farmers who are irrigating from the river are using up all the water from the Murrumbidgee*." versus " *Irrigation has depleted water supplies from the Murrumbidgee River system*."

- Text 2 has removed the agent (farmers). This makes the text more objective by concealing who is using the water. It may be useful to provide students with the start of a model, such as the following:

Under this government, our state's water management has reached crisis point. This crisis combines increasing pollution with poorer management.

Toxic algal blooms threaten the Hawkesbury-Nepean and Murray-Darling rivers. Excessive irrigation causes toxic algal blooms in two ways. Firstly, irrigation can lead to a reduction in the water level to cause stagnation.

Secondly, the runoff of water from farms often has a high content of phosphorus and nitrogenous fertilisers. Still waters with a high nutrient content produce perfect conditions for algal blooms. The wasteful irrigation practices of farmers must be changed to produce a reduction in the incidence of algal blooms.

Note: Nominalisations are boxed.

- Ask students to rewrite their paragraphs or texts. Where appropriate, ask students to replace action verbs (*threaten, move, manage, pollutes*) with noun groups (*threat*, *movement*, *management*, *pollution*).
- Show students how the verbs associated with those nouns will most likely be linking verbs, e.g. *is, has, produces, causes, results in.*

Phase 4: Independent construction

Activity 8

Sewage pollution

- Students research issues surrounding sewage pollution and select a specific problem.
- Lead a class discussion to share information and focus on main points.
- Students write an essay covering the following points:
  - give the context of the problem
  - describe the problem
  - explain the causes of the problem
  - argue what can be done about the problem.
- Assess students' knowledge and their understanding of the grammatical and structural components of their texts.

References:

Australian Science Education Project (ASEP) (1973) *Water*, Melbourne.

Archer, J. (1988) *On the Water Front*, Pure Water Press, Brunswick Heads.

Knapp, P. (1992) *Literacy & Learning Program Resource Book*, Metropolitan West Literacy & Learning Program, Parramatta.

Metropolitan East Region Disadvantaged Schools Program (1995) *Write it Right* series of units.

NSW National Professional Development Program Consortium (1996) *Literacy Across the Key Learning Areas Years 7 & 8*, Sydney: Training and Development Directorate, NSW Department of School Education.

Bookmarks

http://www.erin.gov.au/index.html
Environment Australia On-line

http://www.ozemail.com.au/~hncmt/
Hawkesbury-Nepean Catchment Management Trust: Search topics such as: Algae, Health of the river, What you can do.

http://www.uow.edu.au/arts/sts/sbeder/aquapolic.html
History of Sewage Pollution in Sydney Harbour.

http://www.waterwatch.org.au/
Waterwatch Australia

http://www.apa.gov.OGWDW/
This is the home page of the United States Environmental Protection Agency, Office of Ground Water and Drinking Water.
It contains much information on such things as the organic and inorganic contaminants found in drinking water and their effects on humans. There is also a students' (and teachers') page that presents a number of activities and looks at the water cycle etc.

http://www.wqa.org/
An American consumer organisation looks at water quality.

Further Reading:

Australian Science Teachers Association (1992) Literacy in Science Education, Special Edition. *Australian Science Teachers Journal*. Vol 38, No.4.

Christie, F. (1990) The Changing Face of Literacy. In F. Christie (Ed.) *Literacy for a Changing World*. Melbourne: Australian Council for Educational Research.

Knapp, P. & Sturgiss, J. (1992) *Teaching Genre and Grammar in Secondary Science*. Parramatta: Metropolitan West Literacy & Learning Program, NSW Department of School Education.

Mamouney, R. (1990) *Assessing Writing: Scientific Reports*, Erskineville: Disadvantaged Schools Program Metropolitan East Region, NSW Department of School Education

Marshall, A. (1996) *Communicating Ideas and Information in Science*. Canberra: Australian Science Teachers' Association.

Martin, J. (1990) Literacy in Science. In F. Christie (Ed.), *Literacy for a Changing World*. Melbourne: Australian Council for Educational Research.

Metropolitan East Disadvantaged Schools Program (1995) *Write it Right*, various publications.

Bookmarks

http://www.epa.gov/OGWDW/kids/bloopers.html
Six ways to conserve water and improve water quality. This can be used as a resource for writing expositions, as reasons are given for each action.

http://www.cabq.gov/resources/index.html
A detailed, but easy to follow presentation of how the US city of Albuquerque is dealing with its water conservation problem. Includes procedures to save water outside the home and procedures to save water inside the home.

http://www.abc.net.au/btn/
Behind the news: contains summaries of the programs over the past three years. Has a very useful search engine.

http://www.erin.gov.au/index.html
Environment Australia On-line

http://www.uow.edu.au/arts/sts/sbeder/aquapolic.html
History of Sewage Pollution in Sydney Harbour.

http://www.streamwatch.aus.net/
Streamwatch NSW (Waterbug survey): Comprehensive description of water bugs; health of waterways can be determined by the types of bugs that live in them.

http://www.peg.apc.org/~ozgreen/
Contact schools along the Murray-Darling rivers.

BLM 4.1: Scaffold for report

Water report

Location and type of water way: Date, time of day.	Classification:
Describe features of water such as temperature, flow, clarity, acidity, pollutants, plant growth, living things, potential habitats.	Description of physical features:
Describe using labelled diagrams with notes.	Description of water bugs:
Classify according to Streamwatch waterbug survey schema.	Description of water quality:

BLM 4.2a: Deconstruction of a model of explanation

Instructions:

Rewrite the following explanation so that the sentences of each paragraph are in the correct sequence. Note that there are three paragraphs to re-sequence. The first two sentences have been done for you.

Oxygen depletion in water

Animals and plants, ranging in size from very large to microscopic, that live in water need oxygen to stay alive. Two different water pollutants can sometimes lead to a reduction of the oxygen supply in fresh water.

1. As a result some animals and plants may die.
2. This sudden increase in demand for oxygen is the second cause of oxygen depletion.
3. The animals and plants in the water take oxygen out of the water faster than it can be replaced, leading to oxygen depletion.
4. This reduced level of oxygen in fresh water is called *oxygen depletion*.
5. The first pollutant is oil which spreads over the surface to form a thin film.
6. Animals and plants that die further increase the food supply for the microscopic life forms which continue to reproduce.
7. The oil film prevents oxygen from the air being absorbed into the water.
8. The second pollutant is natural waste material, such as animal faeces and food waste.
9. As a result the oxygen supply may become so depleted that all organisms that use oxygen in that water die.
10. If their food supply is suddenly increased, they breed very rapidly and produce large numbers.
11. The large numbers require more oxygen.
12. This waste material is food for microscopic life forms in fresh water.

Questions:

1. Name two types of living things that can deplete the amount of oxygen in fresh water.
2. Name two pollutants.
3. The passage is an explanation. Words which connect time and cause-and-effect help to make it successful. List all the words which connect time and cause-and-effect.

5. Apart from the use of these connectives, how else can you tell this is an explanation?
6. Explanations have two parts. Use your rewritten explanation to find the *phenomenon identification* and *explanation sequence*. Draw a box around each part and label it.

OHT 4.2a: Correctly re-sequenced version of the text on BLM 4.2a

Oxygen depletion in water

Animals and plants, ranging in size from very large to microscopic, that live in water need oxygen to stay alive. Two different water pollutants can sometimes lead to a reduction of the oxygen supply in fresh water. This reduced level of oxygen in fresh water is called *oxygen depletion*.

The first pollutant is oil which spreads over the surface to form a thin film. The oil film prevents oxygen from the air being absorbed into the water. The animals and plants in the water take oxygen out of the water faster than it can be replaced, leading to oxygen depletion. As a result some animals and plants may die.

The second pollutant is natural waste material, such as animal faeces and food waste. This waste material is food for microscopic life forms in fresh water. If their food supply is suddenly increased, they breed very rapidly and produce large numbers. The large numbers require more oxygen. This sudden increase in demand for oxygen is the second cause of oxygen depletion. Animals and plants that die further increase the food supply for the microscopic life forms which continue to reproduce. As a result the oxygen supply may become so depleted that all organisms that use oxygen in that water die.

BLM 4.2b: Deconstruction of a model of explanation

1. Select connectives from the list provided to complete the passage about bacterial regrowth in water pipes.

Connectives

whereas	**after**	**afterwards**	**also**	**when**	**if**
however	**with the result**	**besides**	**once**	**then**	

Bacterial regrowth in water pipes

One of the most difficult problems for water authorities is the reappearance of significant quantities of bacteria in the water distribution system. These appear to live and multiply in the water pipelines, finding shelter and nutrients in the build-up of algae which takes place over time. Bacterial regrowth occurs even with chlorine added to the water supply.

(1)…………… algae take hold, they collect silt, metals, or other particles and begin to shrink the diameter of the pipe. (2)…………… there is considerable thickness of algae, a biofilm coating can develop on the area in contact with the water. This biofilm can seal off the layer of algae from the disinfecting action of the chlorine, (3) …………… that bacteria can grow and multiply in a protected and nutrient-rich environment.

(4) …………… there is a sudden violent flow of water or any other disturbance of the surface of the biofilm, (5) …………… the bacteria and other organisms will be released into the water supply.

This threat to health has the potential to reach very serious proportions, with the authorities in Sydney and Adelaide in 1985 reporting some difficulty in dealing with the situation.

Adapted from John Archer, *On the Water Front*

2. Answer the following questions:

   (a) What is a significant problem for water authorities?

   ……………………………………………………………………………………………

   (b) What is meant by “disinfecting action”?

   ……………………………………………………………………………………………

   (c) What is a biofilm?

   ……………………………………………………………………………………………

   (d) What sort of problems could be caused by bacteria in our water supply?

   ……………………………………………………………………………………………

   ……………………………………………………………………………………………

OHT 4.2b: A solution to cloze activity in BLM 4.2b

Bacterial regrowth in water pipes

One of the most difficult problems for water authorities is the reappearance of significant quantities of bacteria in the water distribution system. These appear to live and multiply in the water pipelines, finding shelter and nutrients in the build-up of algae which takes place over time. Bacterial regrowth occurs even with chlorine added to the water supply.

(1) **Once** algae take hold, they collect silt, metals, or other particles and begin to shrink the diameter of the pipe. (2) **When** there is considerable thickness of algae, a biofilm coating can develop on the area in contact with the water. This biofilm can seal off the layer of algae from the disinfecting action of the chlorine, (3) **with the result** that bacteria can grow and multiply in a protected and nutrient-rich environment.

(4) **If** there is a sudden violent flow of water or any other disturbance of the surface of the biofilm, (5) **then** the bacteria and other organisms will be released into the water supply.

This threat to health has the potential to reach very serious proportions, with the authorities in Sydney and Adelaide in 1985 reporting some difficulty in dealing with the situation.

BLM 4.3: Model exposition text

The benefits of mulching your garden

There are many benefits in mulching your garden.

Mulch reduces the amount of weeding. Mulch covers the soil and blocks the light from emerging weeds, causing them to die.

Mulch reduces the amount of watering required in the garden. A layer of mulch covering the garden bed considerably reduces the amount of evaporation of water from the soil. Hence, less watering is required.

Mulch improves soil quality. When mulch breaks down it adds nutrients and organic matter to the soil.

Mulch can be made from recycled materials, thereby reducing the amount of garbage going to our tips. Mulch can be made by chipping tree and shrub prunings, or by shredding newspaper, or it can be made from lawn clippings.

Furthermore, mulch can be an attractive addition to the garden. Whilst mulch can be made from shredded newspaper, mulch made of bark or wood chips makes an attractive alternative.

These are but a few reasons why mulching your garden makes sense.

OHT 4.3: Deconstruction of model exposition text on BLM 4.3

The benefits of mulching your garden

	Thesis	There are many benefits in mulching your garden.
Argument 1	**point** / *elaboration*	**Mulch reduces the amount of weeding**. *Mulch covers the soil and blocks the light from emerging weeds, causing them to die.*
Argument 2	**point** / *elaboration*	**Mulch reduces the amount of watering required in the garden.** *A layer of mulch covering the garden bed considerably reduces the amount of evaporation of water from the soil. Hence, less watering is required.*
Argument 3	**point** / *elaboration*	**Mulch improves soil quality**. *When mulch breaks down it adds nutrients and organic matter to the soil.*
Argument 4	**point** / *elaboration*	**Mulch can be made from recycled materials, thereby reducing the amount of garbage going to our tips**. *Mulch can be made by chipping tree and shrub prunings, or by shredding newspaper, or it can be made from lawn clippings.*
Argument 5	**point** / *elaboration*	**Furthermore, mulch can be an attractive addition to the garden**. *Whilst mulch can be made from shredded newspaper, mulch made of bark or wood chips makes an attractive alternative.*
Reinforcement of the thesis		These are but a few reasons why mulching your garden makes sense.

BLM 4.4a: Text and transformation table for activity 7

This government has managed our water resources poorly. Our rivers and oceans are being polluted more and more.

Toxic algal blooms threaten the Hawkesbury-Nepean and Murray-Darling rivers. Farmers who irrigate with too much water cause algal blooms. When farmers use so much water, only a little is left in the rivers where it stagnates. Also, when they irrigate with too much water, water that runs off carries dissolved phosphorus and nitrogen fertilisers back into the rivers. Still waters with a high nutrient content produce perfect conditions for algal blooms. Farmers who wastefully irrigate their land must change if we are going to reduce the number of algal blooms in our rivers.

Verb	**Noun**
manage	*management*

BLM 4.4b: A model exposition in the form of a "letter to the editor"

Letter to the editor

Under this government, our state's water management has reached crisis point. This crisis combines increasing pollution with poorer management.

Toxic algal blooms threaten the Hawkesbury-Nepean and Murray-Darling rivers. Excessive irrigation causes toxic algal blooms in two ways. Firstly, water taken from the rivers reduces the water flow in the rivers almost to stagnation. Secondly, the runoff of water often has a high content of phosphorus and nitrogenous fertilisers. Still waters with a high nutrient content produce perfect conditions for algal blooms. Irrigation practices of farmers must be changed to reduce their reliance on excessive water.

Crudely treated sewage is dumped in the oceans near beaches. Untreated sewage found on Sydney's beaches has forced their closure on many occasions. There are 23 sewage treatment plants along the Hawkesbury-Nepean river system. All sewage treatment plants need to be upgraded to ensure no effluent flows into our waterways and oceans. Instead of this, the government has abandoned the $7 billion Clean Waterways program.

Spending on consultants has doubled. Household operating costs are up 23%. The $80 environmental levy has funded the Government's $200 million dividend raids and not these essential environmental works.

Chapter 5: Planning a whole-school approach to literacy

This chapter should be read in conjunction with *Planning a Whole-School Approach to Literacy,* NSW Department of School Education, 1997, which has been written to help schools to plan for literacy improvement by:

- interpreting and using Year 7 ELLA results as a basis for future planning;
- evaluating the effectiveness of current literacy strategies;
- assessing staff expertise in relation to literacy;
- identifying, assessing and using available resources;
- refining or modifying organisational or administrative structures; and
- refining or developing whole-school literacy plans.

Such a whole-school approach to literacy will have the following results:

- schools will use the Year 7 ELLA results and other student literacy data as a catalyst for improving students' literacy achievements;
- schools will use the Year 7 ELLA results as a basis for school planning and programming;
- school activities will focus more on improving the literacy outcomes of students;
- teachers will have more knowledge about the literacy demands of key learning areas; and
- teachers will know more about how to teach subject content through appropriate generic and subject-specific literacy strategies.

(Adapted from *Planning a Whole-School Approach to Literacy*, NSW Department of School Education, 1997, page 12.)

This chapter will briefly outline the key steps which schools should undertake as they work towards developing a whole-school approach to literacy.

Establish literacy as a school priority

At faculty and whole-school meetings, teachers can discuss and develop understandings about the literacy demands of various KLAs and subjects. The district literacy team can provide advice to faculty groups about ways to identify and describe these literacy demands.

The Curriculum Directorate booklet, *Focus on Literacy,* a position paper on the teaching of literacy, makes a useful starting point for meetings and professional development activities related to literacy. It does this by addressing the key elements of the State Literacy Strategy and providing information about the effective teaching of literacy in an explicit and systematic manner.

Chapters one and two of this book describe in detail the literacy skills, knowledge and understandings that students in Year 7 need to demonstrate in order to be successful. It also describes the kinds of prior knowledge and skills which students bring to the secondary school by looking at the learning experiences of students in the senior primary years.

Having established an understanding of the literacy demands of each subject, teachers should then examine their teaching programs to identify opportunities for systematic and explicit literacy instruction.

The literacy support team in the school should assist in highlighting opportunities to develop students' literacy skills in each subject. Support teachers, such as ESL teachers and STLDs, should be involved in providing advice about specific strategies to assist those students who require additional support. Teacher-librarians have a significant role to play in assisting students to use information skills as they work with a range of resources to gain and use information.

The school as a whole needs to recognise the value of a whole-school approach to literacy and to ensure that it becomes part of the school management plan. Ways of meeting the professional development needs of individual teachers and faculty groups should be included in the plan. Teachers could be surveyed to establish their current knowledge and expertise and degree of confidence with teaching literacy in their KLA. *Planning a Whole-School Approach to Literacy, Appendix 1* contains an example of a survey.

Sample survey from: *Planning a Whole-School Approach to Literacy*, Appendix 1.

[illegible]

Name: ______________________________

[illegible] *range of contexts.*

1. List any formal training qualification in literacy

(a) Preserve

____

(b) Inservice

____

2. Do you have any other relevant training that could be useful in the literacy area at this school? e.g. public speaking, writing, acting, computing…

____

____

3. [illegible] others in the work place.

____

____

____

4. [illegible] a component? If so, please list.

____

____

____

5. List any literacy resources and/or strategies of which you are aware that could be used to benefit teachers and students at this school.

____

____

____

6. What classroom literacy activities do you use in your classroom?

Sometimes	Often	Regularly

(a) What literacy programs or strategies do you think have been successful at this school?

____

____

____

(b) Why?

____

____

____

8. (a) What literacy programs or strategies do you think have not been successful?

____

____

____

(b) Why?

____

____

____

[illegible]

Determining priorities within the plan

In order to develop an appropriate literacy plan for the school, information about students' current literacy achievements needs to be analysed. The ELLA results can provide useful information about individuals' and year groups' strengths and weaknesses. An analysis of the areas in which students require additional support will indicate a focus for the plan. Other information can be gathered by analysing School Certificate and Higher School Certificate results. Data gathered by teachers through informal assessment and formal assessment tasks will also highlight areas needing support.

Having collected and analysed all available data, the staff should determine priorities within the school plan. These priorities should also reflect the State Literacy Strategy. For example, the ELLA results and teachers' observations might demonstrate that 70% of students have difficulty with paragraphs in their writing. In a school where this is the case, this could become an area to be addressed by all teachers in the writing tasks which they set for students.

Developing goals or objectives for the school plan

Priorities should then be translated into goals for students and teachers. These goals need to be written in clear language that defines precisely what is to be achieved. Some goals will refer to short-term achievements while others will be long-term. A short-term goal might be that *all teachers are trained in the NPDP, Literacy across the KLAs, Years 7 & 8 modules*. A long-term goal might be that *increased numbers of students are successful in 2 Unit chemistry and physics courses.*

Some of the goals will have implications for teachers' professional development, and this will need to be documented in the plan, including what form the professional development will take, how it will be provided and how it will be funded.

Resourcing the school plan

Collect information about available human and material resources. This will include the expertise which already exists within the staff and the district. It will also include collecting information about literacy programs which are already in the school.

Appendix B in *Planning a Whole-School Approach to Literacy* offers one way of doing this. Determine which programs are achieving their outcomes and are aligned with the outcomes of the school plan.

Decide whether additional resources will be required to achieve the outcomes of the school plan. If additional human resources are needed, how will these be found? Will it require a more flexible organisation of the school timetable? If additional material resources are required, how can these be budgeted for in the school plan? Ensure that all staff have the opportunity to provide input to the resourcing of the plan.

Planning a Whole-School Approach to Literacy, Appendix B.

(B) Mapping Existing Programs and Strategies

Step 1:	*List all literacy programs and strategies operating in the school.*
Step 2:	*For each strategy or program, you may wish to ask some of the following questions or you may wish to include others.*

1. What is the program?

 ____

 ____

2. When was it developed?

 ____

 ____

3. Is it still current?

 ____

 ____

4. For whom was it designed?

 ____

 ____

5. Is it achieving its stated outcomes?

 ____

 ____

6. How do you know?

 ____

 ____

7. How is it implemented?

 ____

 ____

8. Is it used by all people who should use it?

 ____

 ____

9. Is it part of whole-school planning?

 ____

 ____

10. Is it part of financial planning?

 ____

 ____

11. Is it simple, practical and reliable?

 ____

 ____

12. Does it fit in with current DSE Policy?

 ____

 ____

13. Are there adequate resources for the program?

 ____

 ____

14. Is it supported by training and development?

 ____

 ____

15. Has it influenced student participation in teaching and learning outcomes?

 ____

 ____

16. How do you know whether or not it has made a difference to student learning outcomes?

 ____

 ____

 ____

Informing parents and the community

Parents and community members could be involved in developing the school plan. Participants could be drawn from the Parents and Citizens Association, local community groups or parents who express a particular interest. All parents and caregivers should be kept informed of the development and progress of the plan through meetings and newsletters. It might be necessary to provide information in a range of community languages.

When reporting on students' achievements, each KLA should include information about literacy achievements and indications of areas requiring additional support. The nature of the support being supplied by the school should be indicated. To do this teachers will need to include literacy achievements in the criteria they apply to assessing students' work and have a plan in place to assist those students who are experiencing difficulties.

Evaluating the plan

Procedures for evaluating the overall success and the outcomes of the plan should be established and written into the plan. For long-term outcomes, indicators might need to be established to ensure that the school is working purposefully towards the achievement of those outcomes.

Case study – Auburn Girls High School

More than 96% of the students at Auburn Girls High School are from non-English speaking backgrounds. The combination of low socio-economic status and significant ESL learning needs provides a challenge in all curriculum areas. Improving literacy was seen as a way to improve achievement in the School Certificate and Higher School Certificate.

The school collected and analysed data about the school structure and teaching and learning programs. The following specific problems were identified:

- curriculum fragmentation
- teacher isolation
- students were passive learners, and did not take responsibility for their own learning
- transition from primary school presented difficulties, in that students were not transferring prior learnings from an integrated setting to a subject specific setting
- students felt overwhelmed by their new setting
- students' low literacy achievements affected every aspect of learning
- many staff felt frustrated by lack of knowledge about how best to support students' literacy learning.

The staff identified their two main goals as:

- improving students' literacy achievements, and
- assisting students to become more active learners.

A staff and student survey highlighted the following school related features that, in their view, had a negative impact on learning outcomes:

- too many split classes in Year 7 and Year 8
- effective learning time was lost with students working in 40 minute blocks
- the learning environment was too noisy
- access to space and resources, such as computer rooms, was difficult, especially for junior classes.

In consultation with the parent community a three phase plan was devised and implemented.

The program commenced in 1995 with Year 7 targeted, and extension to Years 7 and 8 was planned for 1996.

Phase 1:

Year 7 became a priority when timetabling. No class was to be split and, wherever possible, the number of teachers was reduced so some teachers taught across two subject areas, e.g. science and maths, English and history. Periods were increased to 80 minutes, which made the school a quieter learning environment, with fewer bells and less movement. The day was restructured with only one period after lunch, and the need for room changes was minimised. Period 0 was introduced to provide greater access to specialist rooms.

Phase 2:

This phase involved changing the ways classes were structured and the ways students learned and worked. Students were organised into learning teams of four students in each Year 7 class. These teams were fixed for one year and, wherever possible, remained stable across all KLAs. This enabled teachers to focus on group work. It provided opportunities for students to develop their oral language skills in a non-threatening environment, to learn to work cooperatively and to take risks with their learning.

The aims of the student teams were:

- to have students take responsibility for the learning of all team members
- to encourage students to become active learners
- to promote inter-cultural cooperation and tolerance
- to promote mixed ability teaching and peer tutoring.

Students were taught how to work in teams and received training in cooperative skills, team building and conflict resolution. As a team they developed a team code and team goals. Teachers implemented a student-centred approach and adopted the role of facilitators. A resource teacher was employed to follow the student teams, assessing their effectiveness and providing ongoing support to ensure that students were coping with the changes and working effectively.

Phase 3:

Teaching teams were introduced. These teams were made up of teachers already allocated to Year 7 classes and those who expressed an interest in being involved. A coordinator was appointed to oversee the work of the teaching teams. Weekly meetings were scheduled for each team. These meetings provided opportunities for teachers to:

- find out about any issues involving their class
- plan common literacy strategies across a whole term
- undertake inservice on specific literacy teaching strategies
- implement collaborative teaching strategies
- discuss and develop student management strategies
- discuss individual student's progress and welfare issues
- obtain information about learning in other subjects, so that the transfer of skills and knowledge could be maximised
- develop "buddies".

In 1997 students representing each class became involved in the teaching team meetings.

Whole school approach

At executive, staff and faculty levels, team reports are a regular focus. This ensures that all teachers are involved in and aware of the team's project. Literacy development has been identified as being integral to meaningful learning and as being just as important as the teaching of content and is therefore a priority of the school.

An AST literacy was appointed and a school literacy team established. This team coordinates literacy development throughout the school. Large sections of school development days are allocated to professional development in literacy teaching, and parents are invited to participate in these sessions. Special sessions and meetings were also organised for parents to inform them of the project. Wherever necessary, interpreters were involved in these sessions. Keeping parents and the community informed of the project is seen as being an essential ingredient for success.

The science faculty

Science teachers have been involved in the initiative since its inception. Teachers have found that the professional development in literacy teaching has been invaluable and have transferred many of the strategies to their work with senior students. The opportunities to meet with colleagues from other faculties has been most beneficial. These meetings enable teachers to discuss students' progress and plan literacy and content teaching. This has assisted students to transfer their learning from one subject to another.

Current initiatives

Literacy teaching programs are being implemented for Years 7-10. The school is part of the Granville District Middle Years Project, which is developing improved systems for transferring information about students' literacy achievements and other data to ensure a smoother transition from primary to secondary school. This project has also provided additional inservice training for teachers in effective literacy teaching.

Summary of whole-school approach to literacy at Auburn Girls High School